ELECTRICAL WORLD

SEPTEMBER 5, 1931
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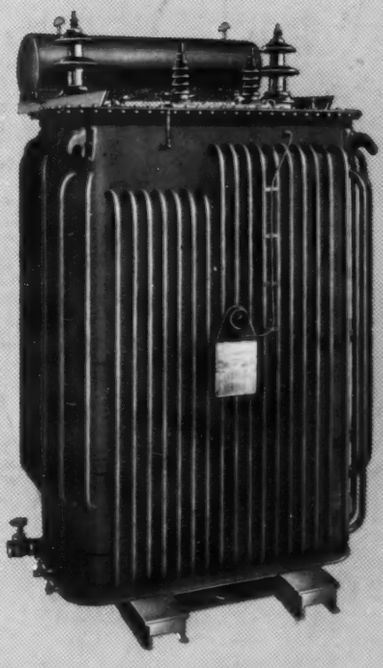

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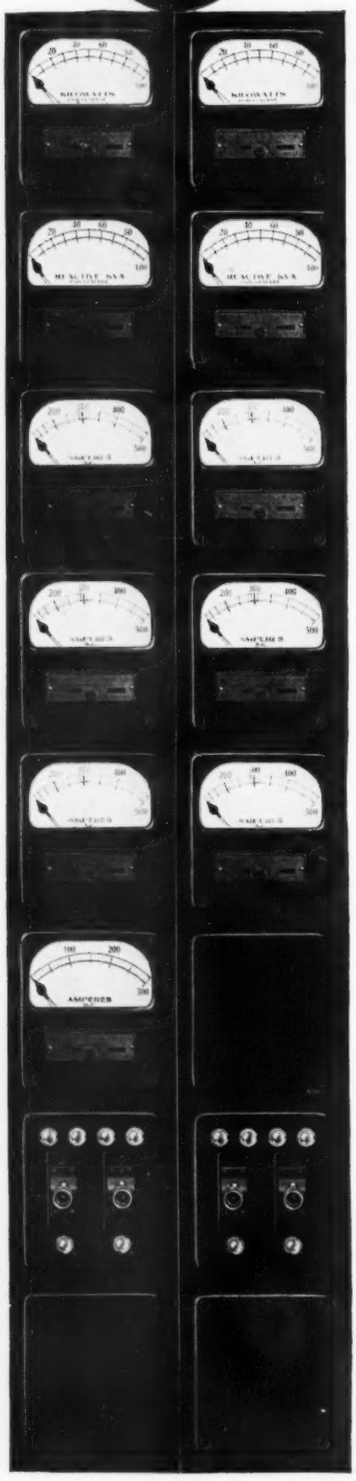

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4. Reduced "human error"—operator closer to instruments and control switches.
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7. Ease and speed of installation—units shipped completely wired ready to connect to external circuits—additional units simply bolted on.
8. Flexibility of arrangement—all parts interchangeable and standardized as to size.
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A consolidation of Electrical World, Electrical Engineer and American Electrician

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ELECTRICAL WORLD

for the Week Ending

September 5, 1931

Rented water heaters build load

—**Consumers rent water heaters** from utility company for a dollar a month in Portland, Ore. Plan to speed use proves satisfactory. Available to any consumer who signs for service for three years on flat rate— *p. 427.*

—**Structural-shape conductors** show increased efficiencies. Engineers develop busbars of aluminum which are said to overcome the shortcomings of tubes and bars. Installation costs reduced; overall savings shown—*p. 418.*

I have a conviction that the most important function of a utility executive is to see to it that those whom he serves know his company as he would wish it to be known.

J. F. OWENS,
President
National Electric Light Association

Autonomy for good public relations

—**Let the local manager manage** is admonition of executive of one holding organization which has recently inaugurated a new policy to give local autonomy in the interest of maintaining good public relations—*p. 428.*

—**Hydrogen-cooled generators** have definite economic merit, concludes development engineer who foresees extension of this principle as next major step in turbo-generator design. Experimental service data reported—*p. 408.*

—**Direct-stroke theory backed** by field experiences and slow cloud ionization, contends Westinghouse engineer who sees it physically impossible for a cloud to discharge in short enough time to give very high induced voltages on the line—*p. 420.*

Woodring denies anti-utility bias

—**Kansas utilities are praised** by Governor Woodring, who sees them to be both good citizens and fair corporations. Single exception, to blanket approval, as extended by the Governor, was cause of recent row—*p. 398.*

—**Far more efficient boilers** result from increased steam pressures and temperatures, but recent progress has been so rapid that standardization lags in new designs. A new era in boiler practice impending?—*p. 410.*

—**Electric heat is economical** according to shop experience of a large railroad. Savings amount to six times the cost of the electric heat and are represented by definitely improved results—*p. 423.*

Railroad saves with electric heat

Kansas Governor Praises Light and Power Utilities of His State

SPEAKING to 4,000 persons at Baldwin, Kan., last week, Governor Harry H. Woodring of that state had much to say of the utility situation in the commonwealth and especially the matter of rates. After condemning "one of the largest and most ruthless of these corporations"—the allusion evidently being to the Cities Service Company, whose contention with the state administration over gas rates has been reported in previous issues of the ELECTRICAL WORLD—the Governor said in part:

I am happy to say that for the most part the state, proceeding in an orderly, legal manner, has met with hearty co-operation upon the part of the heads of most Kansas utilities. Meeting these men around the council table, we have found them not only willing but eager to meet the situation fairly and promptly. I am happy to report that Kansas public service companies have voluntarily as a result of these conferences announced reductions in gas rates affecting 136 cities and in electric rates affecting 330 cities. It is quite probable in some instances that the state through the Public Service Commission will be obliged to fight to the bitter end, but I am confident public sentiment will win.

In this fight I am concerned only in the reduction of rates to consumers. All other matters which may have arisen coincident with this controversy are beside the point. I feel certain that if all utility rates, as well as other necessities, can be brought to the same level to which the incomes of the farmer and the small wage earner now have been reduced, much good will have been accomplished toward relieving the present situation. Reductions in electric rates already announced average from 11 to 18 per cent. In some of the large towns the rate was cut down as low as 4 cents per kilowatt-hour.

The small consumer will be benefited as well as the large user. The saving will vary from 25 cents a month up, depending upon the amount of energy used. In many instances new gas rates include the elimination entirely of a service charge. With one company, which announced its rate change effective with September meter readings, the new rule sets the minimum charge not to exceed $1. Heretofore in some instances the minimum charge has been as high as $1.50 and even $2 a month. Also one company has inaugurated a policy of eliminating all service charges.

I cannot emphasize too much the pleasure I have found in the hearty and instant co-operation I have received from many of the Kansas-owned and Kansas-operated utilities. It showed beyond question the powerful influence of a candid discussion of the situation such as could be held when men interested in the same proposition, though from different angles, get together round a table in a businesslike manner. These men are interested in earning dividends on their stock, and certainly I have no disposition to destroy the earning power of any stock owned by Kansas citizens. They realize as does every one else that when labor and other costs are cut to a minimum, then the product may take a similar reduction without eliminating dividends. . . .

The public utility magnate who refuses to reduce prices in line with lowered production costs is a menace to the public utility corporations who do lower their prices and give good service at a reasonable cost. It is the renegade industrial autocrat who arouses in the minds of the people a resentment which leads to drastic legislation injurious to all other industries, and it is these renegades with whom we must contend. We must fight our economic battles without abandoning our belief in our individualistic economic organization.

▼

Kansas Gas Rate Case Goes to Highest Court

APPEAL WAS FILED with the United States Supreme Court on August 31 by the Western Distributing Company, a Cities Service Gas Company subsidiary operating in Kansas, against a decision of a three-judge statutory federal court sitting in that state that the company in contesting before it a rate order of the Kansas Public Service Commission had not exhausted its remedy before the state regulatory body.

The lower court held that the plaintiff, before it can seek any remedy in the federal courts, must show that the price it pays for gas at the city gate and other charges paid Henry L. Doherty & Company and the Cities Service Gas Company are fair and reasonable. The fact that the rate at the city gate is an interstate rate does not preclude inquiry by the commission, it was held, into the reasonableness of such a rate for the purpose of fixing the local rates at Eldorado.

▼

A RHAPSODY IN STEEL

Any young woman can now operate the controls for a reversing steel-rolling mill by this "piano"-type General Electric keyboard. The foot pedals cause two 5,000-hp. motors to reverse from full speed to full speed in less than two seconds.

▼

President Skinner Views Engineer in Human Field

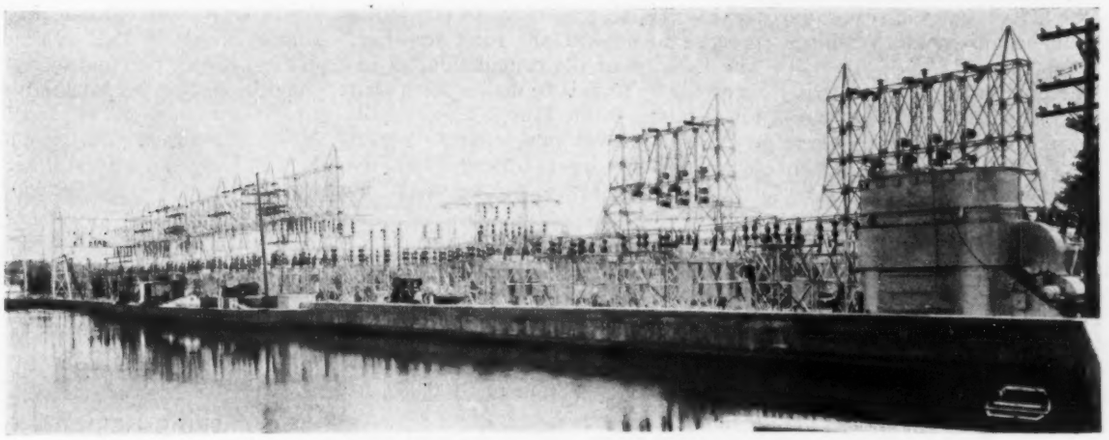
ALL DOUBTS AS TO the practicability of holding a Pacific Coast convention of the American Institute of Electrical Engineers at a spot removed from the larger cities were dispelled when 249 registered for the meeting of that group at Lake Tahoe, Calif., on August 25-28. Attendance at the four general and two student sessions showed a remarkably high percentage of those registered. Papers were of a high caliber and well diversified and several evoked considerable discussion.

In addressing the first session Dr. Charles E. Skinner, president of the Institute, said that the machine age has brought a host of problems and that the engineer had even been accused of being responsible for some of the present-day ills. The engineer must be humanized and apply his methods of analysis and solution of engineering problems to the broader problems of social and economic welfare, he maintained.

Speaking briefly of Institute activities, F. L. Hutchinson, national secretary, predicted that much would be accomplished for the welfare of the electrical engineer through the work of a committee recently formed consisting of some of the most prominent members of the Institute. He also spoke of the importance of having one engineering body that was qualified and authorized to speak for the entire engineering profession in matters of state-wide interest. Several states have such bodies and others are in the process of formation.

Among the papers exciting discussion was one on electric power in the wood-products industry, by C. E. Carey and K. L. Howe, which brought out the surprising fact that more than 2,000,000 kw.-hr. a year is used in the pulp and paper and lumber industries in Oregon, Washington and Idaho, a consumption equivalent to the entire central-station output in these states. Salvation of the lumber industry, it was declared, depends upon greater use of power and in converting every part of the tree, even to the bark, into commercial products. As less and less waste is available for power generation in isolated plants a tremendous market should be available for power companies in supplying elec-

NEW CABOT SWITCHING STATION OF TURNERS FALLS POWER & ELECTRIC COMPANY



Here, near Greenfield, Mass., two 110-kv. tie lines connect the system with the New England Power Association network, from which 110-kv. and 69-kv. lines run to the Connecticut Valley and Berkshire Hills. The switch yard is on the east side of the power canal serving the Cabot station and was designed to occupy a space about 600 ft. long by 60 ft. wide, using flat bus construction throughout.

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trical energy and process steam, if only they are alert to the opportunity that lies ahead.

Discussion was also brought out by a paper on oil-field electrification of which H. C. Hill and J. B. Seleque were the authors. It disclosed a solution to one of the most difficult problems in oil-well drilling, that of applying motor drive to mud pumps without the danger of destroying the pump because of high motor torque when a stoppage occurs. Speed and torque characteristics of the steam engine have now been duplicated by inserting resistance and reactance into the rotor circuit of slip-ring motors so that the motor may be stalled at 250 per cent load and remain so for several hours without danger of burn-out.

A valuable contribution to the knowledge of stray load losses on large hydraulic turbine-driven generators at short circuit and under rated load was contained in a study on calorimeter measurements made on a large unit in Canada. The investigation of the authors (G. D. Floyd and J. R. Dunbar) showed a remarkable agreement in losses under the two sets of conditions. This was thought to be of great importance to operating men since premiums are now commonly placed on the efficiency of prime movers and since manufacturers of these units are demanding greater accuracy in determination of generator efficiencies because the generator output is the only means of determining horsepower input to the turbine shaft. In this stray load losses are an important factor.

Tie-line control of interconnecting networks was the subject of a paper that brought lively discussion. This paper, presented by C. A. Powel and T. C. Purcell, dealt with a specific case where tie-line load regulators on one system operated satisfactorily in conjunction with frequency control on the other. Discussion brought out two schools of thought, one whose adherents advocate frequency control and one which puts the emphasis on load control. It was contended that frequency control at one end of a tie line and load control at the other might impose undue burden upon one of the other of the utilities involved and that frequency control is the solid backbone upon which successful tie-line operation depends.

Necessity for quantitative measurments of field intensity was forcibly brought out by H. N. Kalb and C. C. Campbell in a paper dealing with radio co-ordination. Work at Oregon State College has shown that interference field strength only one-tenth that of the broadcast signal strength is sufficient to cause unsatisfactory radio reception.

A number of other papers were presented in accordance with the program printed in the ELECTRICAL WORLD for August 8, page 226. One evening meeting was held, at which C. E. Grunsky, president of the American Engineering Council, ably discussed "Business Cycles and Some Economic Problems." Next year's convention will be held at Vancouver, B. C.

▼

Many Utility Contracts Are Voided in New York

MORE THAN 400 CONTRACTS made with large consumers by utilities in New York State were ordered abolished on Wednesday by the Public Service Commission because the contracts conferred special rates and privileges at variance with the published rate schedules on file with the commission. All contracts made henceforth must be filed with the commission, the order directs. This course was indicated by the commission several months ago when it conducted an investigation to ascertain how many special contracts were in existence. In Greater New York the commission found sixteen special contracts between electrical companies and consumers that did not agree with the rate schedules filed with the commission. The rest of the state reported enough to put the total at the figure already mentioned.

▼

Good Progress Reported on Power Board's Quiz

PROGRESS OF THE Federal Power Commission's survey to determine the investment at Niagara Falls has been expedited materially, it is stated, by the cordial co-operation given by representatives of the company. The plant at Niagara Falls long antedates the passage of the water-power act. This makes it necessary for the commission to secure the data upon which fair value as of the date of the federal license can be based. The Federal Power Commission as soon as it determined to make the study suggested to the New York authorities that they join in it. This the latter have not seen fit to do.

Commission is in receipt of a report of progress from Dr. W. M. W. Splawn, its special research assistant in charge of the study of ownership and control of federal power licensees. Correspondence with the companies has developed few requests for interpretation of the questions, and no power company has declined to supply the information

requested. Several of the largest systems have reported that they are assembling the data and will have the rather voluminous answers in Washington before September 15.

One of the analysts employed in this special study is making a full examination of all the records of the Federal Trade Commission's investigation. A table of contents and summary of the testimony will be prepared for the Power Commission's use, but the examination has already, it is asserted, disclosed that it would be impracticable to fill in answers to the Power Commission's questionnaire from the Trade Commission's record even for holding companies already investigated.

▼

Two Power Companies Bid for Muscle Shoals Energy

MEETING IN PLENARY SESSION at Washington for the first time on Monday, the new Muscle Shoals Commission opened the only seven bids connected with the lease of the Muscle Shoals government properties which had then been received in response to the 136 invitations to bid which the commission had sent out. Two of these bids were from power companies, the Alabama Power and the Tennessee Electric Power; three from chemical firms, the Davison Chemical Company of Baltimore, the Chemical Development Company of New York and the Baily Furnace Company, and two from individuals, F. E. Castleberg of Shreveport, La., and Lloyd H. Smith of Battle Creek, Mich. The power companies, it is stated, are interested only in purchasing such surplus energy as might be available after the fertilizer requirements had been met.

Virtually every one of these proposals is of a tentative nature. Not even the President could authorize acceptance of a bid. For this reason the commission is not trying to hold any one down to a definite bid but is merely seeking to ascertain the most favorable terms at which the project can be leased. Chairman Hobbs stated that the recommendations that the commission will make will give preference to plans that promise to produce the most fertilizer. The function of the commission, as interpreted by him, is to devise some plan for disposing of the Muscle Shoals project. If it proves impossible to obtain a satisfactory lease from private interests or from farm associations, he believes that the only alternative will be public operation. Mr. Hobbs believes that estimates of the cost of modernizing nitrate plant No. 1 are misleading, since he regards this plant as being obsolete and unworthy of consideration. Plant No. 2, however, can be modernized by the expenditure of $100,000, he states.

Further offers will be received until November 1, and those who have submitted proposals will be permitted to amend them or to make revisions. Although it was stated previously by members of the commission that the most acceptable proposal probably would come from the American Farm Bureau Federation, no definite proposition has as yet been submitted by that organization. It is understood, however, that one is being drafted. A curious feature about the proposal that the Farm Bureau Federation is expected to lay before the commission is that it probably will involve a scheme to obtain federal aid in financing the lease. Thus money would be withdrawn from the Treasury as a loan to farm bodies, which in turn would pay it to the War Department.

Fertilizer Industry Has Own Muscle Shoals View

PROVOKED BY CONSTANT reiteration of the statement that Muscle Shoals is a fertilizer proposition, spokesmen for the fertilizer industry are charging the administration with wholly and deliberately ignoring the fact that the only modern plant on the government reservation is the Wilson Dam power plant and that the two nitrogen plants present this interesting but somewhat pathetic picture: No. 1 has never produced a single pound of nitrogen; No. 2 in a test run back in 1919 produced approximately 276 tons and not a pound since. Fertilizer manufacturers declare that Muscle Shoals in 1931 is first of all a political proposition and second a power proposition, that its potential usefulness for the production of fertilizer lies wholly in the past. They say that today there is a world overproduction of nitrogen in the face of a shrinking market and that American producers of synthetics are working far below capacity and carrying over a surplus of tens of thousands of tons.

▼

Indiana Utility Persists in Asking Regional Rates

ANOTHER ATTEMPT to get the Indiana Public Service Commission to approve uniform rates for the so-called "South System" of the Public Service Company of Indiana was made this week by that utility, whose last previous endeavor to the same end, disapproved by the commission, was in connection with the rate case instituted by the city of Bloomington, Ind. (ELECTRICAL WORLD, August 15, page 267). The new attempt took the form of a petition to the commission to investigate electric rates in southern Indiana with a view to establishing more equitable and non-discriminatory schedules.

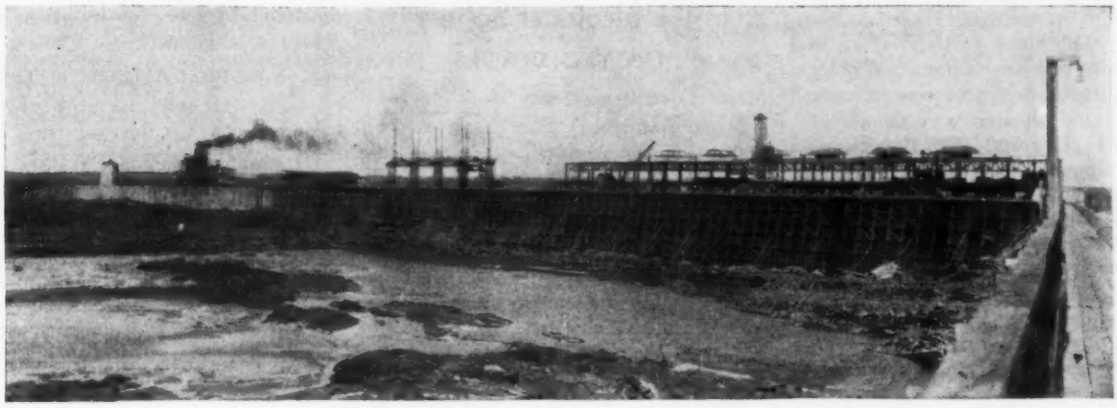
The territory affected extends over 24 counties in the southern part of the State in which 75 communities as well as a widespread rural territory and a number of quarries, mines and other industries outside the towns are served with electricty. The company insists that the "South System" is developed to operate as a unit and that "as a result of the gradual development of petitioner's South System, pursuant to the orders of the Public Service Commission of Indiana, rate structures have been formulated and adopted with insufficient consideration of the South System as a whole or of the communities of comparable size and character within the South System."

SHOALS BOARD

Left to right, front: W. F. McFarland, Ala.; S. F. Hobbs, Ala.; Col. J. I. McMullen, Col. H. B. Ferguson; Mercer Reynolds, Tenn. Back: W. H. Smith, Ala.; E. A. O'Neal, American Farm Bureau; J. F. Porter, Tenn.; Major G. P. Hill, Col. Max Tyler. Capt. T. H. Green, secretary.

—Underwood & Underwood

RAPID PROGRESS ON 224,000-HP. HYDRO PLANT AT CHATS FALLS, ON OTTAWA



Power from the big development at Chats Falls, on the Ottawa River, one of the largest hydro-electric projects under construction in Canada, may be delivered by October. It is a joint undertaking of the Ontario Hydro-Electric Power Commission and the Ottawa Valley Power Company. There are to be eight—eventually ten—28,000-hp. turbine units. The dam is three miles in length. Transmission to Toronto will be at 220 kv.

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Bragg, Marconi, Thomson to Pay Tribute to Faraday

A COMMEMORATION ADDRESS in honor of Michael Faraday will be delivered at Queen's Hall, London, by Sir William Bragg on Monday, September 21, the first day of the centennial celebration of the discovery of electromagnetic induction. Sir William is the director of the Royal Institution, a post which was held by Faraday in his time. Others who will pay tribute to the great British electrophysicist are Marconi, Elihu Thomson, Prime Minister MacDonald and the Duc de Broglie. This commemorative meeting of Monday evening will be broadcast in England by the British Broadcasting Corporation, while in the United States the National Broadcasting Company will rebroadcast a portion of the program between 4 and 5 p.m. Eastern daylight-saving time.

The exhibition to be opened on Wednesday morning, September 23, has been arranged principally by the Institution of Electrical Engineers and will be open to the public for about ten days. The central feature of this exhibition will be reproductions and illustrations of Faraday's actual experiments, prepared by the Royal Institution, together with a display of some of his historic apparatus. Faraday's chemical and electrochemical work, which, while not so well known as his discovery of electromagnetic induction, nevertheless is hardly less remarkable, will be illustrated by means of special exhibits arranged by other co-operating societies.

Upon invitation of both the Royal Institution and the Institution of Electrical Engineers, the American Institute of Electrical Engineers has appointed Dr. William McClellan, past-president, as its delegate to the celebration and Dr. A. E. Kennelly, also a past-president, as alternate.

Preceding the opening of the exhibition, General Smuts, recently elected head of the British Association for the Advancement of Science, will deliver an address. On behalf of the other American societies invited to participate, another past-president of the Institute, Dr. F. B. Jewett, is scheduled to deliver brief felicitations by radio telephone at that time.

Among the many other interesting features of the celebration comes the announcement of the publication of Faraday's diary, two volumes or more of which are expected to be ready by the time the celebration takes place. Faraday maintained a careful diary of all of his experimental work, which has been the possession of the Royal Institution for over 60 years unpublished.

▼

St. Paul Tax Will Force Energy Rate Over Rival's

ST. PAUL CONSUMERS of electricity will pay higher rates than Minneapolis users if the Northern States Power Company is forced to continue payment of a gross earnings tax in St. Paul. This prediction was made on August 26 by Robert F. Pack, president of the Northern States Power Company, in an address before a St. Paul association. Mr. Pack discussed a proposed franchise from the city of St. Paul to his company. He pointed out that his company is the largest tax-paying concern in St. Paul. The gross earnings tax of 5 per cent totals about $385,000 annually, he said. This tax is not imposed in Minneapolis and is not in lieu of other taxes, which total $553,000.

New York Utility Cases in Court and Commission

RETURNING FROM an enforced trip outside the state due to the illness and death of a relative, Milo R. Maltbie, chairman New York Public Service Commission, said this week that he would soon respond to the letters from Corporation Counsel A. J. W. Hilly of New York, noted last week (page 358), which said that scores of commercial customers of New York City companies were complaining that the new rates were bringing them increased instead of decreased bills.

The New York Edison Company, it is understood, regards such cases as the natural accompaniment of putting into effect a new type of rate and desires to adjust them equitably.

It was stated that most of these complaints originate from the demand charge in cases where customers who have been billed on the basis of installed capacity are claiming that under present business conditions their installed capacity does not represent their actual present demand. The utility company is using the measure of installed capacity as a temporary expedient pending the arrival of demand meters. No complaining customer will have service discontinued without due consideration of his complaint, it is said.

Application made by Earl Carroll, New York City, for an order compelling the New York Edison Company to furnish direct instead of alternating current to his new theater (ELECTRICAL WORLD, August 15, page 270), was denied last week in the State Supreme Court, which ruled that the company in carrying out a policy approved by the Public Service Commission was not discriminating against the Earl Carroll Theater, that

there was no law specifying the type of current to be supplied by an electric company to its customers and no common-law obligations to that effect, and that if there was any contractual obligation to furnish direct current it ceased when the old theater was demolished. The court remarked that the plaintiff had had time to place his grievance before the Public Service Commission instead of making a late appeal to the courts.

To the absence of Chairman Maltbie is attributed somewhat protracted delay in acting on the proposed tie-in between the Niagara-Hudson and New York Edison Company power systems at Poughkeepsie, which calls for expenditure of $7,400,000 and on which work was halted early in the summer because the commission had not acted. Neal Brewster, member of the commission, is quoted as saying that that body would not be "stampeded" into a decision.

In an answer filed with the commission by E. H. Rosenquest, president of the Westchester Lighting Company, to complaints against that company's rates promise is made to submit to the commission revised schedules of general electric and gas rates which would be advantageous to consumers and "would make possible reductions in follow-on rates in the future." The new scale, Mr. Rosenquest indicated, would keep the minimum charge at $1 a month, but the 9½-cent kilowatt-hour charge would be reduced on accounts of 40 hours or more and again at 80 hours. A reduction in the 9½-cent rate now is not provided until the consumer has used 190 kw.-hr.

Scattered Happenings in the Electrical Sphere

UNITED STATES

Maine Commission Seeks More Power

Announcement is made that at the next session of the Maine Legislature there will be a move to give the Public Utilities Commission of that state complete authority to investigate electric rates and the financial structure of power companies and other utilities. An appropriation sufficiently large to hire trained experts able to "cope with those of the utilities" will also be sought.

More Controversy in Kansas Rates

Disapproval was expressed by Public Service Commissioner Hill of Kansas of the new rate made by the Empire District Electric Company for Columbus, Kan., reported last week, on the ground that because of the discontinuance of a 10 per cent discount for prompt payment, the rate was not a reduction, but an increase. He therefore rejected this rate while approving that for Baxter Springs. The Western Light & Power Corporation, Salina, has instituted a further saving to customers by cutting down the energy to which its top 10-cent rate applies from 50 kw.-hr. to 25 kw.-hr.

Forbid Commission to Fix Minimum Rates

A three-judge federal statutory court in Montana has enjoined the Montana Public Service Commission from enforcing its order fixing minimum rates that may be charged for gas service by the Great Northern Utilities Company in Shelby, Mont., on the ground that it denies the right of competition and contract. The gas company had been ordered to increase its rates to equal those of a competitor.

Municipal-Plant Agitation in Texas

Oscar Monnig, member of the Fort Worth City Commission, has informed the Texas Electric Service Company that unless it again reduces its rates in that city in the near future a fight will be started to issue $2,000,000 of bonds for a municipal power plant. The Council of Crystal City has entered into a contract with Fairbanks, Morse & Company for the construction of a municipal electric light plant, subject to a referendum vote within thirty days. The proposed plant and distributing system will cost approximately $128,000.

Empire Corporation Under New Control

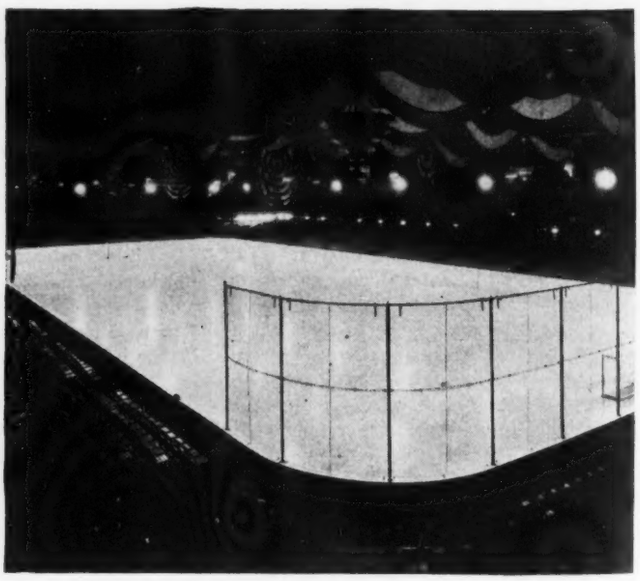
Control of the Empire Corporation of Philadelphia has passed to the Appalachian Gas Corporation, bringing to the latter many light and power, natural-gas, telephone, water and ice utilities. Light and power properties at Findlay, Ohio; Caney, Kan.; Golden, Colo.; Hominy, Okla., and Bridgeport, Tex., are affected.

To Sell Ten Southwest Missouri Plants

The Ozark Utilities Company, a Doherty concern, has applied to the Missouri Public Service Commission for authority to sell electrical properties in ten towns in southwestern Missouri to the Missouri Public Service Company, an Insull utility. The price would be approximately $320,000. The properties are in Burgess, Iantha, Irwin, Jerico Springs, Hannon, Liberal, Milo, Moundville and Sheldon.

▼ ▼ ▼

MODERN LIGHTING FLOODS BALLROOMS AND HOCKEY RINKS ALIKE, WEST AND EAST



On the left is the colorama in Sweet's Persian Gardens, Oakland, Calif., where 4,250 lamps on experimental three-phase, four-wire circuits are used with the latest devices in hidden coves and modernistic design. On the right is an indoor hockey rink, 90 ft. by 180 ft., in the Broadway Auditorium, Buffalo, N. Y., lighted by 32 1,500-watt floodlight projectors.

Seattle Light Building in Trouble

Negotiations have been started under which the city of Seattle may take over from the City Light Building Company, a private corporation, what has been completed of the City Light Building at Third Avenue and Madison Street, for its actual worth to the City Light Department. Only the basement and subbasement of the structure, designed for 26 stories, have been finished, financing difficulties preventing further progress. City Light was to have rented office and power substation space in the building for $92,000 a year. The building was to have cost about $2,000,000.

Line Extensions in Iowa

Sanction from the Iowa State Railroad Commission has just been given for the construction of about 100 miles of transmission lines throughout the state as follows: Iowa Public Service Company, 51 miles; Iowa Southern Utilities Company, 30 miles; People's Gas & Electric Company, 13 miles; other companies, 6 miles. More petitions for permits await action.

Utility Substation Exempt from Seizure

The decision that the city of Decatur cannot levy upon and sell a substation of the Georgia Power Company in that city to meet a disputed assessment over paving between car tracks has been rendered by the Georgia Supreme Court, which ruled that the city could levy upon property of the company in Decatur, but that the substation was an integral part of the property of a public utility necessary for the rendering of public service and therefore could not be sold to meet an assessment against other property.

Niangua River Hydro Project

Application has been made by the Missouri Electric Power Company of Dubuque, Iowa, to the Missouri Public Service Commission for a certificate of convenience and necessity for the construction of a hydro-electric dam and power plant on the Niangua River, about 27 miles northwest of Lebanon. The project would cost $689,398.

Oregon Hydro Commission Sued

Myers & Lee, a California engineering firm, have notified the Oregon Hydro-Electric Commission that action for damages in the aggregate sum of $4,746,967 will soon be instituted with the commission members and the state named as defendants. The complainants allege that the damages involved resulted from the action of the state authorities in canceling applications for permits to appropriate water from the Illinois River and develop hydro-electric power to the extent of 113,000 hp. on the Rogue River. They say that it was not the intention of the promoters to generate energy for the retail market, but exclusively for mining operations, and that the cancellation rendered the development of mining and smelter projects impossible. The commission canceled the applications on the ground that a state law withdraws Rogue River from power development.

Water-Power Resources of Hoh River

According to a report just issued by the Geological Survey, the Hoh River, one of the largest streams draining the Olympic Peninsula in northwest Washington, possesses 56,000 potential horsepower for 90 per cent of the time and 114,000 hp. for 50 per cent of the time. With regulation these amounts can be increased to 83,000 hp. and 119,000 hp.

Coming Meetings

Southwest Power Conference—Kansas City, Sept. 7-11. A. L. Maillard, 1330 Grand Ave., Kansas City.

Pennsylvania Electric Association—Bedford Springs Hotel, Bedford Springs, Pa., Sept. 9-11. H. A. Buch, Telegraph Bldg., Harrisburg.

Empire State Gas and Electric Association—The Sagamore, Bolton Landing, Lake George, N. Y., Sept. 10-11. C. H. B. Chapin, Grand Central Terminal, New York.

Maryland Utilities Association—Vindobona Hotel, Braddock Heights, Md., Sept. 11. D. E. Kinnear, 803 Court Square Bldg., Baltimore.

International Association of Electrical Inspectors—Eastern and Western Sections (joint meeting), Pittsburgh, Sept. 14-17. R. W. E. Moore, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. Southern Section, Dallas, Sept. 21-23. R. L. Gatewood, P. O. box 1743, Atlanta. Southwestern Section, Sacramento, Calif., Sept. 28-30. C. W. Mitchell, 914 Merchants' Exchange Bldg., San Francisco. Northwestern Section, Salem, Ore., Oct. 5-7. F. D. Weber, 414 Lumbermen's Bldg., Portland, Ore.

National Electrical Manufacturers' Association—New York, Sept. 16-18. A. W. Berresford, 420 Lexington Ave., New York.

American Welding Society—Copley-Plaza Hotel, Boston, Sept. 21-25. M. M. Kelly, 33 W. 39th St., New York.

New England Division, N.E.L.A.—Poland Springs House, South Poland, Me., Sept. 28-30. Miss O. A. Bursiel, 20 Providence St., Boston.

American Association of Engineers—Huntington, W. Va., Sept. 28-30. M. E. McIver, Willoughby Tower, Chicago.

American Electric Railway Association—Atlantic City, Sept. 28-Oct. 2. Guy C. Hecker, 292 Madison Ave., New York.

Great Lakes Division, N.E.L.A.—French Lick Springs Hotel, French Lick, Ind., Oct. 1-3. T. C. Polk, 20 N. Wacker Drive, Chicago.

Association of Electragists International—Hot Springs, Ark., Oct. 5-8. L. W. Davis, 420 Lexington Ave., New York.

National Safety Congress—Chicago, Oct. 12-16. W. H. Cameron, 20 N. Wacker Drive, Chicago.

Illuminating Engineering Society—William Penn Hotel, Pittsburgh, Oct. 13-16. E. H. Hobbie, 29 W. 39th St.,, New York.

National Association of Railroad and Utilities Commissioners—Jefferson Hotel, Richmond, Va., Oct. 20-23. J. B. Walker, 270 Madison Ave., New York.

Wisconsin Utilities Association—Commercial Section, Oct. 22-23. Hotel Loraine, Madison. J. N. Cadby, 135 W. Wells St., Milwaukee.

American Institute of Electrical Engineers—District meeting, Kansas City, Mo., Oct. 22-24. F. L. Hutchinson, 33 W. 39th St., New York.

National Electrical Wholesalers' Association—Starrett's Netherland Plaza, Cincinnati, Nov. 9-13. E. Donald Tolles, 165 Broadway, New York.

North Central Electric Association—Accounting, St. Paul Hotel, St. Paul, Nov. 13 and 14. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

Research Council to Investigate Fuel

Fuel research has been placed on the program of a tour of laboratories to be made in October by a hundred business men and executives under the auspices of the division of engineering and industrial research of the National Research Council. This tour is being organized to show how the nation's industries are turning to scientific research to aid them in solving many major industrial problems in an era of rapid economic changes. Maurice Holland, director of the division, is working out the details of the tour. Prof. D. G. Jackson, chairman of the division, will accompany the investigators, who will visit, among other laboratories, those of the Westinghouse company at East Pittsburgh, Nela Park at Cleveland and the Massachusetts Institute of Technology.

CANADA

Seventh Generator for Paugan Falls

The Gatineau Power Company is completing the installation of the seventh 34,000-hp. generator in the Paugan Falls plant on the Gatineau River in the Province of Quebec. With the new unit this plant will have an installed capacity of 238,000 hp. The increase is required to meet deliveries this October under the company's long-term primary-power contracts with the Ontario Hydro-Electric Power Commission.

Power Company Litigation Continues

Charging the fraudulent issue of $4,700,000 worth of capital stock of the Transportation & Power Corporation, impairment of capital by more than 25 per cent, and liabilities of over $400,000, Robert M. Hallett, Montreal broker, who is a shareholder of the corporation, has petitioned the Superior Court of Quebec to place the corporation in liquidation. The corporation is already fighting a bankruptcy petition filed by Maxwell B. Singer, based on a demand for $5,000 for services rendered in connection with the preparation of the corporation's action for an accounting of $10,000,000 against R. O. Sweezey et al. and the Beauharnois Light, Heat & Power Corporation.

ABROAD

St. Peter's Bells Being Electrified

The bells of St. Peter's Cathedral, Rome, will soon be rung by electricity. The power station in the Vatican City State will supply the necessary current, and the bellringers, who have worked for periods of from 20 to 40 years, will be pensioned off. With electric operation bell concerts can be given.

Westinghouse Electric & Manufacturing Company

It is only a modern water tower, but what an improvement over the old style!

Floodlighting and a new and refreshing architectural concept made it possible.

The idea was to produce a multiplane reflecting surface for concealed floodlights.

Aluminum fins and grillework on a carillon tower are skillfully illuminated.

The installation is on the new home of the Genesee Valley Trust Company, Rochester, N. Y.

EDITORIALS

L.W.W.MORROW
Editor

Equities must be maintained

BANKERS affiliated with the utility industry have recently put stress upon the urgency of keeping the equity proportion of utility capital structures adequate. It is imperative at this time that orthodox principles be adhered to in this respect in preference to following the line of least resistance.

While the business and market outlook remains uncertain there is naturally strong resistance to the distribution of common stock either through the exercise of rights or through ordinary banking and brokerage channels. Undoubtedly also the chilling effect of sliding prices has cooled the speculative instinct of the average investor more than temporarily. Add to these factors the favorable market for long-term money and the relatively high credit standing of the utilities among corporate groups, and the scales seem to tip to the side of senior-type financing.

Yet despite all this many of the utilities are continuously cognizant of their equity financing needs. During the first half of this year rights to buy common stock were offered by power and light companies, and presumably are being exercised by those who acquired them, to a total of more than $120,000,000.

Assuming that these rights are all exercised or have been underwritten, the common-stock proportion of new financing is well over 20 per cent, which is generally regarded as a safe proportion for a well-balanced capital structure. It is to be hoped that this policy, which seemed especially evident the first half of this year, will be adhered to and that it has not been confined to the larger companies as might be surmised from an analysis of a few of the larger issues.

Two ways of building load factor

IN MOST attempts to build up load factor the load curve is examined, the troughs in the curve are considered with regard to the crests, and calculations are made as to how much the load factor could be improved if the valley between them could be filled in. The schemes proposed for filling in this valley have been numerous. Off-peak heating of water for hot-water service or for domestic house heating, off-peak charging of batteries, and off-peak industrial processes, including off-peak electric furnace work of all kinds —all these and other methods have been proposed, and some have been developed with a fair degree of success.

Too frequently, however, sight is lost of the fact that there is a second way of improving the load factor—adding blocks of twenty-four-hour load or loads of 100 per cent load factor. Such a method of building up the load curve can generally be made more quickly effective than filling in with off-peak loads. On the other hand, the method generally involves the finding of loads or industries that have either generated their own energy or that have not applied electricity to their processes because the cost of the service is too expensive. In either event a much closer figuring of costs is necessary to be certain that the rate developed will yield a proper return on the investment involved. Frequently to make an attractive rate possible may involve radical changes in ideas of power-plant or system design. The point is that system load factor can be improved by adding twenty-four-hour loads of high load factor. Why neglect them in seeking purely off-peak loads, which are highly desirable but not the only means of improving system load factors?

Institutional investment the acid test

RECENT changes in legal lists for savings-bank investment have effected sharp increases in the utility list and have curtailed the totals of rail and other bonds listed. The major life insurance companies, a recent study shows, increased their holdings in utility bonds by 426 per cent in about seven years while rail bond holdings advanced less than 50 per cent.

The rigid analysis of securities made by investment officers of these insurance companies and the stiff requirements of the savings-bank legal list are likely to disclose any weaknesses or possible future defects in utility situations. In many cases first-hand studies are made and complete access to figures and books is given to the analyst.

All this makes the increased institutional purchase of these bonds highly significant. The investment officers are familiar with the studies of the Federal Trade and Federal Power commissions. If anything were being hidden that these investigations would disclose or if any excessive rates were bringing unwarranted earnings which public service commissions would be bound to adjust later, with resultant decrease in earnings, the bonds of the companies concerned would be discriminated against. The favorable reception to these securities should have a salutary effect upon utility policies and should be a tangible answer to critics of the industry and add a note of encouragement to force an industry advance.

Service charge helps that October bill solution

ONE significant attribute of the flat initial rate is its tendency to make less difference between winter and summer consumption. This is especially noticeable in instances where this type of rate supersedes a straight-block meter rate.

One company which made such a change about three years ago had previously experienced a difference of 64 per cent between the average August domestic bill and the January bill. After the rate change the difference between the July (minimum) and December (maximum) bill was only 20 per cent. Part of the betterment in the direction of uniformity in use was due to the smaller winter bill resulting from a lowered rate, but the major portion was due to the stimulated use in the summer.

Leveling the usage from month to month has its beneficial effect on the annual load factor and in turn on distribution costs. But much more pertinent is the elimination of that sharp rise in October bills which has been the bugbear of the industry since daylight saving was invented to give war gardens more hours to grow. The influence on public relations is well worth considering when the alternatives are: Shall there be a low energy charge following a flat service and area component or shall there be a pure block rate and minimum monthly bill? The flat charge does better in reducing the complaints that arise when the sun begins to skirt nearer the southern horizon.

Leases and good lighting

LEASES for office floors or manufacturing lofts generally contain such clauses as "Standard lighting fixtures will be provided" or "Adequate lighting will be provided." Then, when the lighting proves unsatisfactory to the tenant, as it frequently does, the questions arise: What is a standard fixture and what is adequate lighting? Standard fixtures are generally taken to mean those accepted as standard for a particular building or a group of buildings with the same owner. "Adequate lighting" is a term which a jury could interpret only by tossing a coin. Those who put such clauses in leases are generally lawyers who do not know that it is possible—or do not care—to be more specific in stating just what kind of lighting will be furnished.

Tenants are not particularly interested in what kind of fixture they will find on their premises; neither are they generally interested to know how well the ceiling and walls will be illuminated. They do want to know what kind of lighting they will have on desks, tables or typewriter stands, but they do not know how to ask for it. Nor do they know that it is possible to ask for anything definite that can be checked in the same manner as the temperature or the dimensions of the room can be checked. When their lighting later proves insufficient, they frequently complain to the utility providing it that they are not getting the right kind of electricity.

In consequence of all this it might be advisable for lighting companies to begin educating their customers to demand definite illumination values, say not less than 12 footcandles on desks, with not more than 25 per cent variation, or whatever value the particular utility may be ready to recommend, and to demand also that there be no glare, using to this end whatever terms a particular utility prefers. Continuous suggestions could be made to customers to insist on the insertion of such clauses in their next leases. For, no matter who is responsible for poor lighting, the utility company generally gets the blame.

Unified service areas suggest unified rate schedules

QUEER discrepancies enter into rate decisions. A Georgia company, to meet competition, reduces rates in one community and the Georgia commission summons the utility to show cause why the downward revision should not apply in all its territory. But when Bloomington, in Indiana, asks the Public Service Company of Indiana to reduce rates and the utility asks the Public Service Commission to consider also the adjoining area, so that prevailing disparities shall not be accentuated by piecemeal adjustment, the Indiana commission refuses.

Circumstances admittedly alter cases, but nevertheless, as a fundamental principle, there should be harmony in rates served from a unified system under single management. It would be to the advantage of the commission as well as to the consumers and to the utility to grasp the opportunity to effect the desired uniformity in rates over a whole area. Preservation of rate differences are a principal source of annoyance to both commissions and companies, provoking weakened faith in regulation as an institution and in fairness of the corporation as a humanized instrument.

There are still plenty of factors which justify differences in the charge for service for different kinds of customer use, for different kinds of community load characteristics and for different kinds of community development. But they are being narrowed, and the commissions should be as eager to narrow them further as any company may be. Any commission which has the authority to initiate rate adjustments should find a way to broaden a localized plea into a territorial study so that incongruities may be eliminated simultaneously rather than serially and disjointedly in a region where service costs have a prominent common denominator.

A system function that needs continuous supervision

WHEN a system first interconnects with an adjacent company it is usually felt that if the tie is sufficient to carry the expected exchange of power and is connected with the backbone network joining generating stations all will be well. But as the number and capacity of interconnections increase it is frequently found that the system which was adequate for transmitting power from generating stations to loads has a new duty imposed on it—transfer of power across it, at least in bucket-brigade fashion, if not transfer *in toto*.

Differing impedances in lines may divide this transfer of load in entirely different proportions from those for which the system network was originally designed. Some links may have to be strengthened. Circuit-breaker capacities may have to be changed. Relay application and settings will have to be reconsidered. Extremely large phase angles may develop at switching points. And lines that were formerly required only to carry load become elastic ties between generating sources and have to be stabilized, or unnecessary functioning of relays and circuit breakers, with outages, will be incurred.

Judging from the experience of some companies, the adaptation of systems to interconnections cannot be settled once and for all, but must be restudied each time new interconnections are made or widely differing methods of operation are adopted. Avoidance of too great concentration of power generation at widely separated points and the installation of synchronous condensers strategically situated at major load centers may reduce instability, but the necessity remains for permanently maintaining centralized responsibility for system stability, economic use of lines, relaying, circuit-breaker application and system additions or changes that affect the system as a whole. An engineering planning department is a necessary part of a system planning department.

Hydrogen-Cooled Generators Have Economic Merit

By M. D. ROSS

Power Engineering Department,
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

IN THE design of large turbo-generators the next major step will no doubt be the adoption of hydrogen gas as a cooling medium. The use of gases with better ventilating properties than air provides a means of producing smaller and more efficient machines. Larger ratings at any speed may be built without exceeding the mechanical limitations.

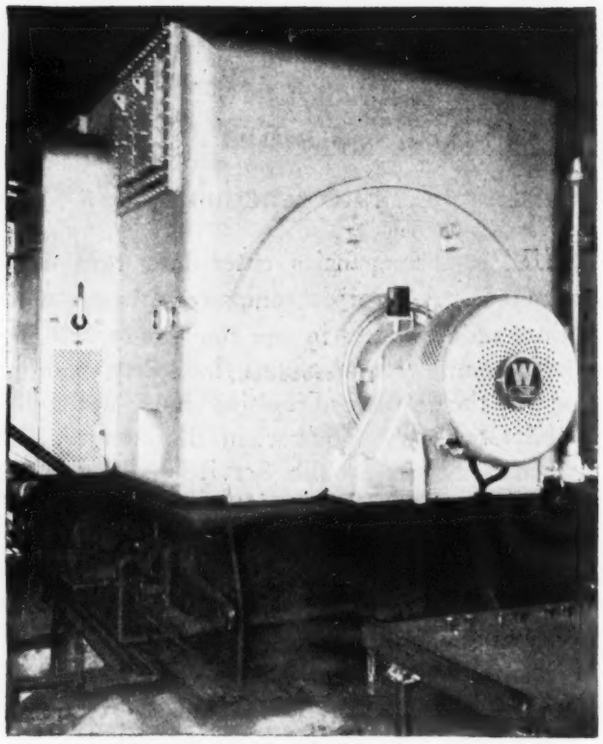
Hydrogen is desirable as it has somewhat better heat transfer properties than helium, lower density and is available commercially at relatively low cost. The density of commercial hydrogen is about 8 per cent that of air, so that windage losses, which are relatively high in turbo-generators, are reduced to a negligible figure. The heat transfer rate with forced convection (using hydrogen) might be as much as two to three times that with air. In general, its properties are such as to permit working the active materials of the machine considerably harder for the same temperature rises. Investigation of its properties when mixed with air showed that, provided the percentage of air is higher than 90 per cent or lower than 30 per cent by volume, the mixture does not explode. It is therefore apparent that, providing suitable means are furnished to maintain the percentage of air in the gas mixture at lower than 30 per cent, it is as safe to operate turbo-generators filled with hydrogen as it is to operate air-cooled machines, particularly if the frame structure is built so that no damage external to the machine would occur in the event of wrong operation of the gas-control equipment. An inert gas is used to drive out the air before filling the machine and to drive out the hydrogen when opening it up for inspection. Suitable gas-tight inclosures for the machines to be so ventilated have been worked out and the design developed to the point where it is applicable commercially.

Considerable work has been done since the possibility was demonstrated by Dr. Pohl in 1923 to work out these details of design. The problems to be dealt with were as follows:

(a) The design of a suitable gas-tight frame structure, including the gas coolers, had to be worked out. This was finally solved by the adoption of welded structural steel members which could be readily tested at the factory for leaks. Suitable bolted joints were also developed for parts which had to be removable for assembly and inspection.

(b) A method of stopping gas flow along the shafts where they come out of the gas inclosure had to be developed. This sealing device had to be of such a design that it would not introduce an excessive amount of air into the hydrogen inclosure. There was no necessity for such a seal in the case of synchronous condensers, where the rotor did not have to be mechanically coupled to a prime mover. The absence of any sealing device largely explains the adoption of hydrogen cooling to condensers to date in considerable numbers, whereas no hydrogen-cooled turbo-generators are now in commercial operation. An oil sealing gland was worked out for the hydrogen-cooled design.

(c) Control apparatus had to be developed automatically to maintain the pressure of the gas in the machine above atmospheric, so as to prevent air from entering. Devices for measuring the percentage of hydrogen in the gas mixture and warning the operator in case of too low a percentage of hydrogen had to be developed.



7,500-kva. hydrogen-cooled generator

Field fed through collector rings at shaft end. Leads to field winding pass through gas-tight stuffing unit. Armature leads out of bottom of machine

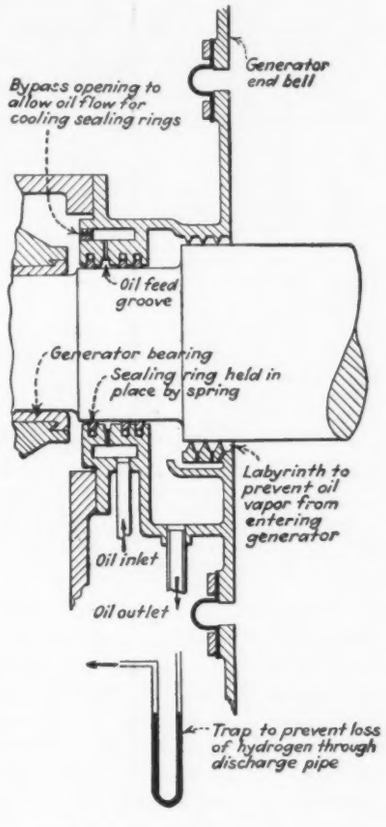
An experimental shaft seal was developed in 1926 which proved to be satisfactory. Oil from the lubricating oil supply pump is forced into a groove in the gland casting and flows both ways over the shaft from the groove, thus preventing leakage of gas along the shafts. The flow of oil is throttled to a minimum by three rings held against the shaft by small springs. It is desirable to reduce the flow toward the hydrogen side of the seal to a mimimum as a certain amount of air

is present in suspension in the oil which might be liberated in the hydrogen inclosure. Fresh hydrogen gas would have to be introduced into the mixture.

Experience with this sealing gland indicated that its mechanical operation was satisfactory and that the infiltration of air with the oil could be reduced to a low figure. The power loss in the seal was very small. In case the oil supply was shut off with the machine shut down the infiltration of air through the seals was very low and a machine equipped with such seals could stand idle for a considerable time without oil pressure.

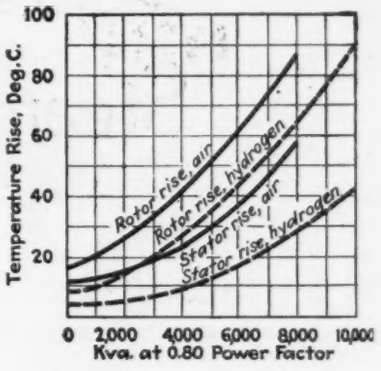
Two turbo-generators rating 7,500 kva. at 80 per cent power factor and 3,600 r.p.m. with air cooling were then built and tested, the first one in 1928 and the second in 1930. Parts of the machine are similar to that of the usual air-cooled machines of that rating. A gas-tight structural-steel frame and end bell structure is provided with two finned tube coolers built into the top of the frame and the water headers designed so that the coolers can be cleaned while the machine is running. Two sealing glands are provided and the field leads are brought out through a gas-tight stuffing nut to collector rings mounted outside the bearing. The armature leads come out of the frame through special gas-tight bushings at the bottom of the machine. The gas control equipment is mounted in a panel bolted to the side of the generator. Hydrogen gas bottles with suitable pressure-reducing valves are provided, installed at some distance from the generator. Carbon dioxide gas bottles are also provided to scavenge the air or hydrogen in filling or emptying the machine.

The latest 7,500-kva. generator was operated intermittently over a period of seven months in 1930. The machine was run as a synchronous motor during the tests, as no turbine was available to drive it. It was filled with gas and scavenged at frequent intervals to obtain experience with the operation. Nothing happened during the seven months' operation which could not readily be handled by the operators, indicating that the design had been carried out to the point where it could be applied to commercial machines. The sealing glands required no special attention and the infiltration of air with the sealing oil was such that about 70 cu.ft. of hydrogen per day was required to maintain the gas purity at 97 per cent. As hydrogen at atmospheric pressure costs about 1 cent per cubic foot, the cost of gas was about 70 cents per day. The sealing glands showed no signs of wear when opened up for inspection.


Generator end bell
Bypass opening to allow oil flow for cooling sealing rings
Oil feed groove
Generator bearing
Sealing ring held in place by spring
Labyrinth to prevent oil vapor from entering generator
Oil inlet
Oil outlet
Trap to prevent loss of hydrogen through discharge pipe

Sealing gland prevents leakage of hydrogen

Oil under pressure seals joints, confines hydrogen and prevents infiltration of air.



Air-cooled rise much higher than with hydrogen

Test results indicated that about 9,375 kva. at 80 per cent power factor could be carried with the same temperature rise as at 7,500 kva., 80 per cent power factor with air cooling. The improvement in efficiency at 6,000 kw., 80 per cent power factor load, due to the reduction of the windage losses from 73 kw. to 7 kw., was 1.1 per cent. Cooling water when operating with hydrogen was 40 g.p.m., as compared with 80 g.p.m. with air cooling.

Advantages worth $1 per kilowatt

Briefly, the advantages of hydrogen cooling as compared to air cooling are as follows:

1. Reduction of windage losses means a saving in fuel of 0.6 per cent or more at full load in the largest machines or 1.2 per cent or more at half load. As an example, the saving in losses might be capitalized as follows:

Assuming (a) A generator of 100,000 kw. rating at 1,800 r.p.m.
(b) Reduction in windage losses with hydrogen—600 kw.
(c) Operating time per year—7,000 hours.
(d) Value of power at the bus 0.4 cent per kilowatt-hour.

The savings can be evaluated as follows:

Value of power at bus (4,200,000 kw.-hr.)	$16,800
Less cost of gas at $2 per day and cost of hydrogen and carbon dioxide for three fillings after shutdown	1,100
Net saving per year with hydrogen cooling	$15,700
Capitalization of savings at 15 per cent	105,000

2. The hydrogen-cooled generator will require less floor space in the power house.

3. Due to its lower losses and better heat transfer in the cooler, the hydrogen-cooled generator will require much less cooling water than the air-cooled generator. The characteristics of the machine are such that condensate can be used in most cases for cooling as the no-load generator losses are relatively low. The air-cooled generator has relatively high no-load losses and the amount of condensate at low loads is not usually sufficient to cool the generator and additional raw water coolers must be furnished to be used at light loads.

4. Windage noises are reduced with hydrogen cooling.

5. Corona has practically no effect on the insulation in hydrogen. This would lengthen the life of the insulation.

6. The hydrogen-cooled generator can be adapted for operation outdoors with very little change from that designed for indoor operation.

From the above, it will be apparent that the hydrogen-cooled design is superior in most respects to the air-cooled design. Maintenance and operating costs should not be higher than for the air-cooled design as the usual station operator can take care of the gas-control equipment satisfactorily. The above figures on capitalization of losses would indicate that the hydrogen-cooled design would be worth about $1 per kilowatt more than the corresponding air-cooled machine.

Steam Pressures and Temperatures T

By D. S. JACOBUS*

Advisory Engineer Babcock & Wilcox Company, New York, N. Y.

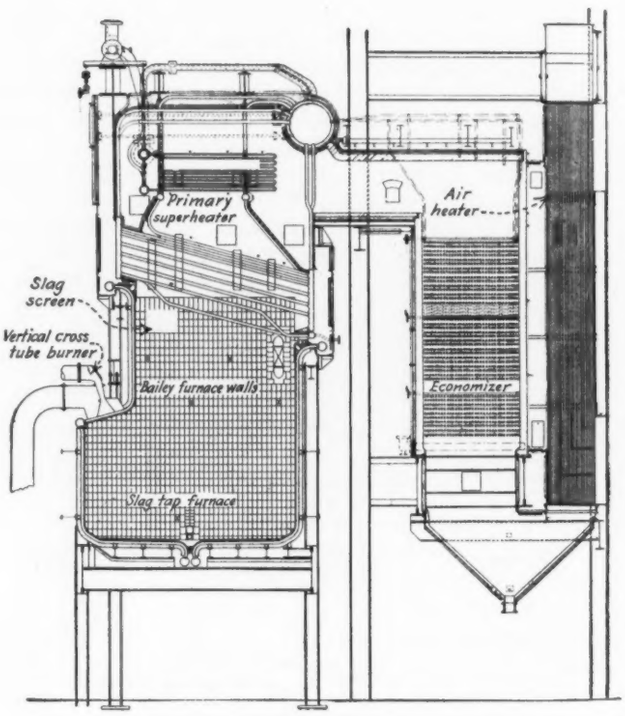
Electrical engineers have noted in the discussions of their mechanical colleagues in recent times an increasing occupation with such subjects as 1,400-lb. boilers and 1,000-deg. superheaters. Evidently the boiler room gang is quite stirred up about these matters which the electrical engineer knows will have effect upon his work as well. This article is an opportunity for the electrical man to learn about these portents and omens in the steam end from an unquestioned authority.

DEMONSTRATING the trend toward higher steam pressures and temperatures in power plant practice is the fact that so far the Babcock & Wilcox Company has installed or on order 119 boilers for operation at from 650 to 800 lb. pressure and 32 for working pressures of about 1,400 lb. There have been improvements in furnaces and in fuel combustion which enable boiler units to be operated at an evaporating capacity of 1,000,000 lb. of steam per hour with a single furnace, as compared to about one-third this figure ten years ago. The over-all efficiency of the steam-generating equipment has increased to 85 per cent and over. This is due to reduction in excess air, more efficient combustion of the fuel being made possible through improved furnace design and improvements in the steam-generating and heat-absorbing parts.

The advance has been so rapid that there has been no opportunity for standardization and each installation has had to be considered by itself in order to secure the best results for the combination of boiler, superheater, economizer and, when used, the air heater. Many have taken part in the development and through the co-operation and skill of the station operating engineers the fears that serious difficulties might be encountered have not been justified; in fact, the high-pressure and high-temperature plants of today are even more reliable than those of a lower pressure as installed ten or fifteen years ago and are easily operated.

A new kind of superheater

In order to meet the demands for high temperatures of superheated steam at high capacity, a new superheater was developed by the Babcock & Wilcox Company, a number of which are now in use. In the new type an even distribution of steam flow is secured between the superheater tubes by supplying steam through a number of tubes having their inlet ends spaced along the steam and water drums and their outlet ends spaced along the inlet superheater header. A special form of shutter baffle has been developed for use in the steam and water drum for eliminating moisture from the steam, which, combined with the method of connecting the steam and water drum to the superheater, makes it possible to operate the boilers at the highest limit of capacity while supplying dry steam to the superheater. The tubes are bent back and forth and so proportioned that the velocity of the steam through them is sufficient to maintain the walls of the tubes at a low enough temperature to avoid burning without causing an undue drop in pressure in the steam flowing through them. In cases where the temperature is too high to use plain carbon steel tubes, "Nirosta" KA2 alloy tubes, which contain approximately 18 per cent chromium and 8 per cent nickel specially treated, are employed. The "Nirosta" tubes are used



Latest form of slag bottom furnace

The water-cooled floor for slag bottom furnaces with vertical cross-tube burners was developed at the plant of the State Line Generating Company, Hammond, Ind. The results of the developments will be applied to the new 1,400-lb. units to be installed at the plant, which will be fired with pulverized coal.

*Abstract of an article read at Chicago before the Chicago section of the A.I.E.E. and the electrical section of the Western Society of Engineers.

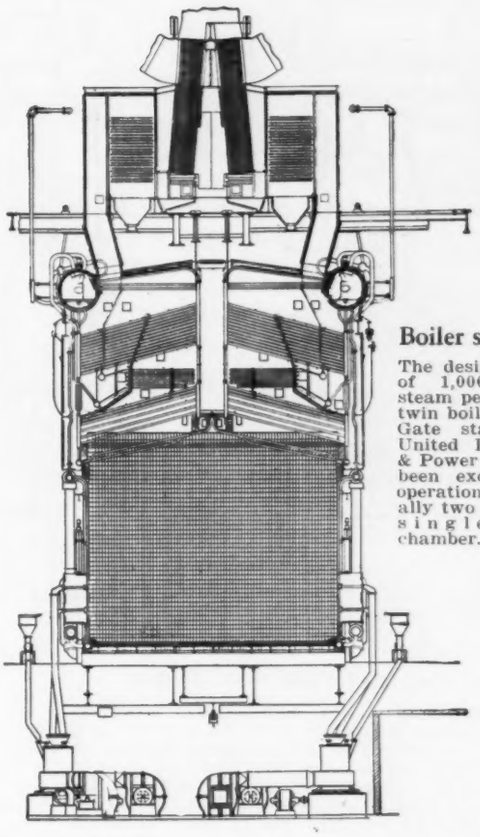
es Trend Higher

for the hotter parts of the superheater and are welded to the ends of the carbon steel tubes by the Thomson electric process.

A slag-tap furnace

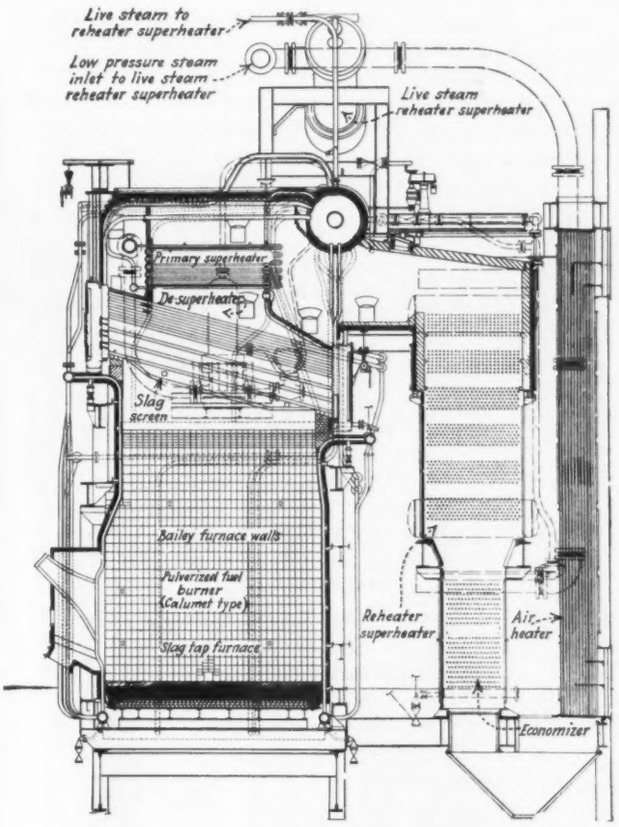
An important development in the burning of powdered fuel is the use of the slag-tap furnace. The slag tap furnace was developed at the Charles R. Huntley station in Buffalo as the outcome of experiments on well type furnaces. In the well type furnaces the powdered fuel burners enter tangentially to produce a rotating action of the gases in the furnace, with the idea of burning a large quantity in the well and allowing the flame and products of combustion to flow upward and expand over a large space, completing combustion before striking the tubes of the boiler. As it was desired to keep the well furnace as cool as possible, to prevent slagging of the ash, cast-iron blocks were first placed on water tubes to form the walls surrounding the furnace. These blocks were calorized, but with the contact available between the block and the tube used at the time the temperature and blast action of the flames caused the blocks to have a relatively short life. Molten ash accumulated in a pool in the lower part of the well and was tapped out intermittently. Refractory faced blocks were then tried and other changes made in the furnace without solving all of the difficulties. The furnace was then rebuilt and lined with refractory faced blocks and the floor raised so that the slag line came up to the blocks. This furnace operated successfully as a well type furnace at a continuous rate of evaporation of 150,000 lb. of steam per hour and could be operated as high as 275,000 lb. of steam per hour for short periods of time; the higher rate, however, resulted in a lowering of the efficiency on account of carrying over unburned fuel in the gases and the furnace was subjected to severe punishment.

The next development was installing Bailey-wall well furnaces which were 16 ft. square in three of the boilers. These large size well furnaces operated the boilers at ratings up to 275,000 lb. of steam per hour at over-all efficiencies of 85 to 88 per cent. The next step was to rebuild the furnace of the boiler that was originally provided with the 8-ft. square well to provide a furnace of the full width of the setting. This furnace was provided with cross-tube burners opposed to each other. Four additional boilers with slag-tap furnaces along these lines were installed with Calumet burners, arranged with the tangential method of firing, in which the maximum capacity was 330,000 lb. of steam per hour. A method of cooling the molten ash with water and han-



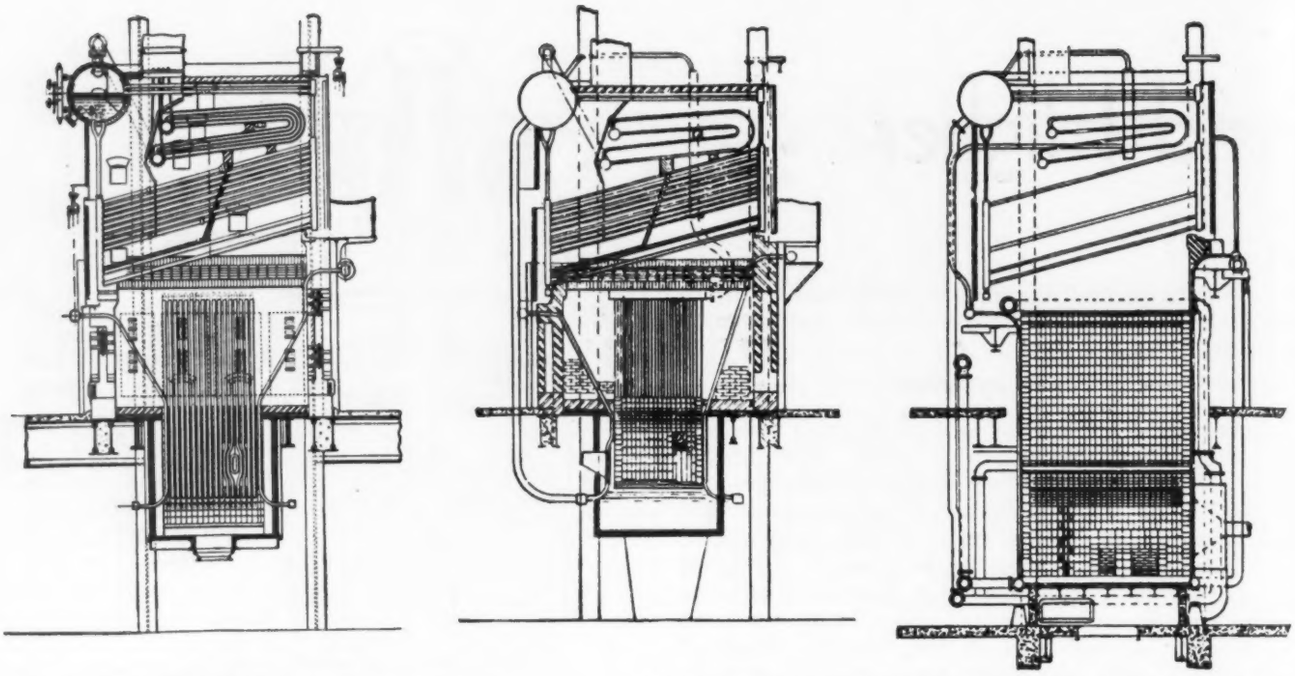
Boiler sizes advance

The designed capacity of 1,000,000 lb. of steam per hour of this twin boiler at the Hell Gate station of the United Electric Light & Power Company has been exceeded in its operation. This is actually two boilers over a single combustion chamber.



Boiler with combined steam and gas reheater

At the South Amboy station of the Jersey Central Power & Light Company this 1,400-lb. boiler is operating. A reheater for re-superheating the steam from an intermediate stage of the turbine to a total temperature of 750 deg. F. by means of the furnace gases is used in combination with a live steam reheater so as to maintain a total temperature of the superheated steam of about 750 deg. F. irrespective of the varying temperature of the steam leaving the steam turbine.



Three stages of slag-tap furnace development

The first design (left) was an experimental well type furnace 8 ft. square, with hoppers at the sides, from which it was proposed to remove the ash deposited in them by the high velocity combustion air. But although some of the ash collected in the hoppers, the greater part accumulated molten in a pool at the bottom of the well, from which it was tapped periodically. The furnace was rebuilt (center) so that the slag line came up to the refractory blocks. The next step (right) was enlargement of the well, with consequent increase of capacity and efficiency.

dling it in the form of sand-like granulars in sluices was developed at the Buffalo plant.

The latest form of floor for slag bottom furnaces where water-cooling tubes are used was developed at the plant of the State Line Generating Company, Hammond, Ind., and at the plant of the Super-Power Company of Illinois, Powerton, Ill.

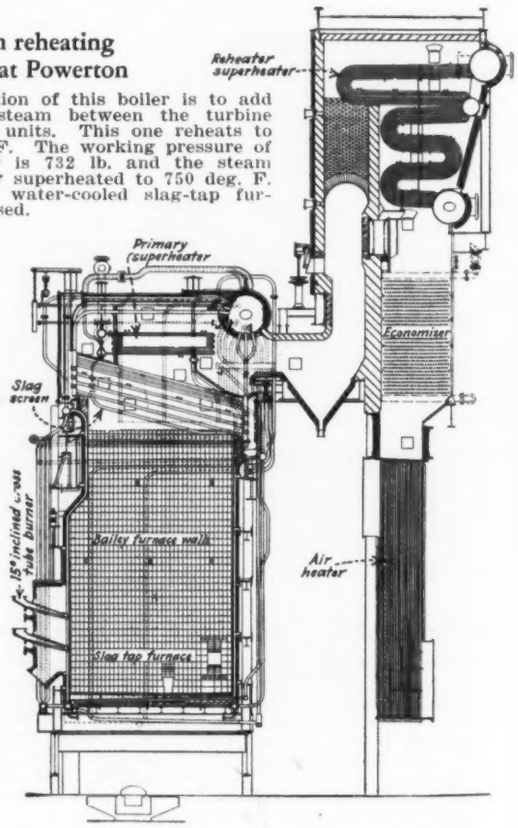
Lower grade fuels, less stock ash

The results secured with slag bottom furnaces at the Buffalo plant, as well as at other plants where they have been used, have demonstrated their merit in making it possible to burn fuels of very different characteristics without trouble, thus allowing a wider range in the selection and purchasing of coal, as it practically removes all limitations of percentage of ash and its fusing temperature. The amount of ash thrown from the stack is greatly reduced. The dust collected from other parts of the boiler may be returned to and melted in the furnace, thus eliminating duplication of ash handling in the dry and molten state. The radiation from the bed of liquid slag assists in combination of the coal, thereby increasing the capacity available for a given furnace volume, and also increasing the amount of heat absorbed by radiation in the boiler, which results in increasing the efficiency.

In operating the boiler at high capacities difficulty was experienced through the collection of slag on the boiler tubes where they were first contacted by the hot gases. To overcome this difficulty the tubes which came nearest the furnace were specially spaced so as to avoid bridging over between the tubes through the collection of viscous slag and unburned particles of fuel and to cause the slag to drip back into the furnace. Various arrangements of these so-called slag screens have been used, in some of which the tubes are in parallel vertical rows instead of being staggered as in the main bank and also with the spacing between vertical rows made greater than in the main bank.

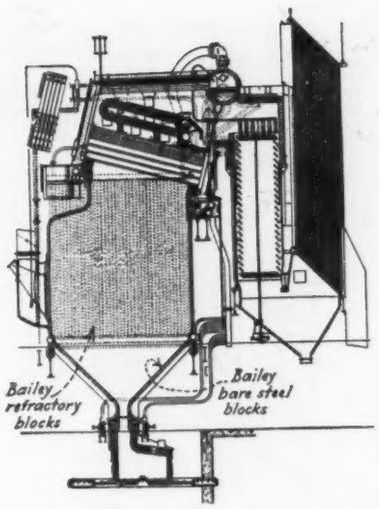
Steam reheating boiler at Powerton

The function of this boiler is to add heat to steam between the turbine stages or units. This one reheats to 760 deg. F. The working pressure of the boiler is 732 lb. and the steam is initially superheated to 750 deg. F. A Bailey water-cooled slag-tap furnace is used.



Two-stage, or steaming economizer, boiler

The first boiler of this kind is in the Calumet station of the Commonwealth Edison Company. The two stages are the boiler proper, in which the steam flows by natural circulation, and an integrally built economizer in which the forced flow method is used.



The latest development in slag-tap furnaces for burning powdered fuel consists in using a combination of vertical firing and slag screen tubes covered with refractory material by means of which the heat generation per cubic-foot of furnace volume and the furnace temperature are increased and a greater amount of the ash is drawn off in the form of liquid slag.

Development of boiler welding

A late development is in the use of electric fusion welding for the joints of boiler drums. Twenty-four boilers with fusion welded drums are now being built by the Babcock & Wilcox Company for United States Navy scout cruisers under specifications based on the A.S.M.E. proposed specifications for fusion welding of drums or shells of power boilers, revised and amplified by the Bureau of Engineering of the U. S. Navy. The joints after welding are subjected to X-ray examination as called for in the specifications, a powerful X-ray machine having been installed for the purpose.

The working pressure of these boilers is 320 lb. per square inch. The welded steam and water drums are $47\frac{3}{8}$ in. internal diameter and 13 ft. $9\frac{3}{8}$ in. over-all length, the plate thickness being $1\frac{7}{32}$ in. The plate used is class A marine boiler plate having a specified range of tensile strength of 60,000 to 70,000 lb. per square inch.

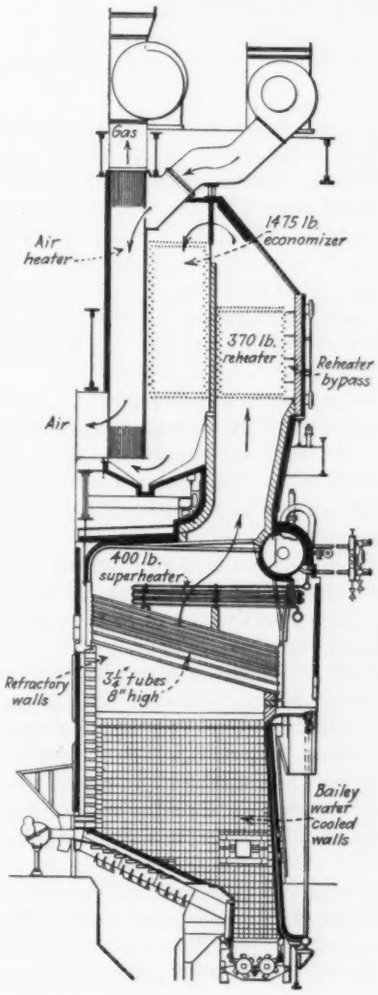
The use of welding lessens the chance of trouble through caustic embrittlement and provides drums of a minimum weight for a given strength. While there has been no instance of caustic embrittlement of a riveted drum properly calked on the inside and not on the outside, a welded drum gives a more definite protection against trouble through this cause. It will not, however, eliminate the necessity for care in the treatment of the feedwater as there have been cases of cracking at the tube holes.

Pressure of 1,400 lb.

The first boiler for a pressure of 1,200 lb. or over was installed at the Edgar station of the Edison Electric Illuminating Company of Boston, then known as the Weymouth station. About two years later two units were installed for 1,400 lb. working pressure, and later two additional units for 1,400 lb. working pressure.

In the development of boilers for higher pressures it was found that ordinary designs of water glasses could not be used as the high temperature water in the boiler would dissolve the glass, or, if an attempt were made to use the existing designs of flat glasses with a mica shield between the glass and the steam and water, the glasses would be broken through cross strains. A number of devices for use in place of water glasses were tested and at the same time efforts were made to develop a water glass which would operate satisfactorily at the higher pressures. A glass that would operate satisfactorily up to pressures of 2,000 lb. per square inch and over was finally developed by H. J. Kerr of the Babcock & Wilcox Company. A flat glass is used, protected by mica on the steam and water side. The joint between the mica and the steam pressure is held tight independently of any pressure exerted on the glass so that the glass acts simply as a support for the mica. The glass is held in such a way as to prevent undue cross strains. These glasses have given good satisfaction and have solved the difficulty of observing the water level at high pressures.

In increasing the working temperature it became necessary to allow for the falling off of the strength of the steel at the higher temperatures. In the early days the tubes of superheaters were made thicker than for the lower temperatures in a more or less arbitrary way. There was no particular risk of a failure of a superheater tube and a method based on the results secured in practice was a logical one to follow. This method could not, however, be followed when, over ten years ago, the Babcock & Wilcox Company was called on to design oil-cracking stills to be operated at a temperature of 825 deg. F. In order to arrive at the proper working stress in the latter case all available data were studied as well as the results secured in superheater



Pressure of 1,400 lb.

Second arrangement of 1,400 lb. boiler used at the Edgar station of the Edison Electric Illuminating Company of Boston, where a boiler for 1,200 lb. working pressure or over for power-plant service was first installed. The boilers have steam and water drums of seamless forged steel.

practice, and a working stress of 8,000 lb. per square inch at 800 deg. F. for a drum or shell was established. At a later date the stresses for higher temperatures were arrived at by scaling down in proportion to the falling off in stresses to produce a given rate of creep, the first curve published by H. J. French of the Bureau of Standards being used for the purpose.

Later on Prof. F. H. Norton of the Massachusetts Institute of Technology conducted a series of accurate tests which were published in his book entitled "Creep of Steel at High Temperatures." The working stresses for steel at high temperatures served as the basis of a paper presented by the author at the annual meeting of the A.S.M.E., December, 1929. The working stresses for drums and shells given in this paper are being considered for inclusion in the A.S.M.E. Boiler Code. The advance has been rapid and there has been no opportunity for standardization. No one can predict the limits of pressure and temperature that will be reached eventually.

▼

Reactors Approach Shipment Limitations in Size

By R. B. GEORGE

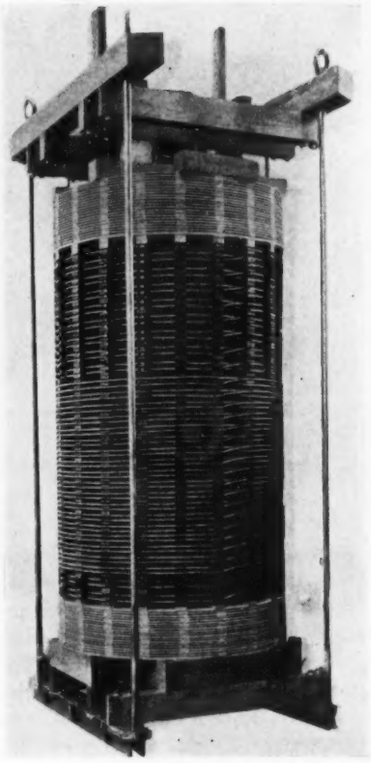
Transformer Engineering Department, Westinghouse Electric & Manufacturing Company, Sharon, Pa.

Current-limiting reactors, like large power transformers, are now reaching proportions which are limited only by shipping restrictions. Three large reactors were needed for the Newark substation of the Pacific Gas & Electric Company at Albrae, Calif. As made by the Westinghouse Electric & Manufacturing Company they have a single-phase rating of 5,400 kva., 60 cycles, 300 amp. to give 28.3 per cent reactance on a three-phase, 110-kv. system. Each is 8 ft. in diameter, 22 ft. high and weighs more than 36 tons.

This substation will have great concentration of power and the reactors are connected in series between two bus sections to limit the short-circuit current to 3½ times normal. Each reactor has a tap for 75 per cent rating and a no-load tap change similar to those used for large high-voltage power transformers. The coils are wound with insulated cables which are insulated and braced similar to high-voltage transformer construction. Large-diameter strands are employed in the cables to give stiffness in the unsupported sections.

A laminated iron magnetic shield is used to protect the tank wall from hysteresis and eddy current losses due to the strong magnetic field external to the windings. A magnetic shield surrounds the coil and is bolted to the tank wall. The laminations are mounted around two heavy angle rings in such a manner that the mechanical forces tend to bind the shield tighter together, similar to an arch.

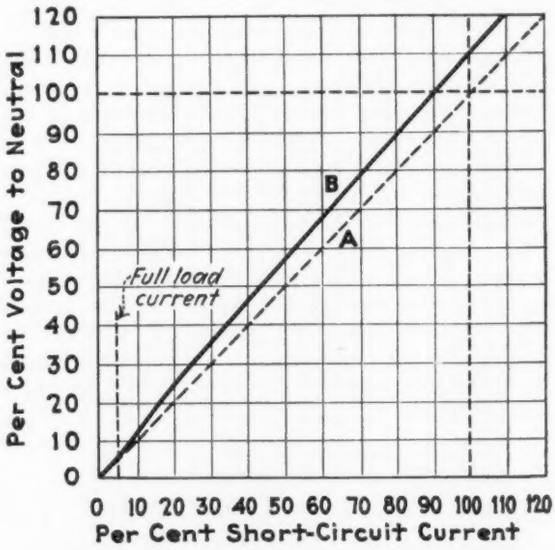
Since the coil has a core of non-magnetic material and the shield is placed outside the coil at the sides, the shield may be considered to be in parallel with the return magnetic path outside the coil. The volt-ampere characteristic curve is a straight line with a small magnetization curve added above it.



Reactor is braced, shielded, oil-immersed

Individually enameled strands in alternate layers of conductors reduce eddy current loss. Connections welded or brazed. Tie rods non-magnetic. Oil protected by Inertaire equipment.

Since the reactor is connected in series between two sections of the same bus, the losses at no load are zero. The major portion of the losses occur in the coils. The comparatively low shield and tank losses are divided over the region from above the coil to a location below the lower end of the coil. The shield has liberal surfaces in contact with the oil for cooling. The total losses in a magnetically shielded, oil-immersed reactor consist almost entirely of I^2R and eddy current losses, which vary as the square of the load current.



Shield gives nearly linear magnetization

(A) Coil only, on test.
(B) Complete reactor assembled in tank with laminated iron magnetic shield. The lower short-circuit current throughout the entire voltage range is a measure of the added protection of the shield. The difference between (A) and (B) is the magnetization curve.

Regulation by Conference vs. Formal Proceedings*

By LEON O. WHITSELL
Member California Railroad Commission, San Francisco, Calif.

REGULATION in California under the public utilities act has been a success. I am not in sympathy with the idea sometimes expressed in high places that the regulation of public utilities by state commissions has proved a failure and that some other method or system should be adopted in lieu thereof. The people of California have full confidence in the utilities act and in their Railroad Commission. This is evidenced by the fact that at practically every legislative session since 1912, through their representatives, they have enlarged the act by amendment and have thereby continued further to clothe the Railroad Commission with additional powers and jurisdiction, until today California stands at the forefront among the states having a regulatory act which adequately covers practically every phase of public utility regulation. In fact, but few states have conferred upon their regulatory bodies the plenary powers possessed by the California commission.

Under the administration and policy of the California commission the people have continued to enjoy adequate service at reasonable rates and industries have grown up and experienced a great measure of prosperity. Rural electrification has kept pace with the progress of the state and the farm load has shown a gradually ascending curve. The domestic use of electric power has continued to increase and it has become the first essential of the home.

Utilities have likewise grown and prospered under regulation; they have been allowed to earn a fair return upon a fair value of the property used and useful in the public service. They have been able, under regulation, to obtain money at reasonably low rates and to finance their undertakings adequately and at all times meet the demands for expansion and keep step with the development and progress of the state. Jurisdiction of the commission over utility financing has proved the wisdom of those responsible for its incorporation into the act and has fully justified the hopes and anticipations of the people. The commission's policy pursuant to that jurisdiction has lowered the cost of money to the utilities. It has stabilized the entire financial structure of the utilities. The commission's scrutiny of security issues by the utilities has instilled in the minds of the people a comforting sense of safety in the ownership of the different issues authorized. Watered stock and overcapitalization are things of the past in California utilities.

For several years there has been a growing feeling on the part of a great many thinking, serious-minded people in California that long, contentious rate proceedings are uneconomical and wasteful and that the utilities should give some thought toward working out a way by which the enormous costs incident thereto may be avoided. In this discussion I have in mind not only the costs but the harmful results which necessarily flow therefrom irrespective of the results attained in the final determination of the case.

Utilities can improve conditions by voluntary action in rate matters and become largely self-regulating

From the very inception of a proceeding to raise or reduce rates, the utilities, the municipalities and other representatives of consumers are resolved into belligerent camps of offensive and defensive; suspicion and accusation run rampant. Advocates of the consumer ofttimes anticipate the final result and broadcast what to them seems the inevitable decision of the commission. The utility, with its auditors, engineers and lawyers, buckles on the armor of defense and the battle is on. Good public relations cultivated through long years of patient effort take wing and, irrespective of the decision of the commission, scars are left on each side which continue as an irritant and a reminder of a contest which in many cases could have been avoided by the utility through the use of the same degree of good judgment exercised in other walks of business life.

In my judgment the remedy to be applied does not

**An address presented before a recent meeting of the Pacific Coast Electrical Association in Del Monte, Calif.*

lie in the realm of the law, but in that of human relations and economics. I will endeavor to outline my ideas as to how the utilities can improve conditions by voluntary action and thus, in a measure at least, become largely self-regulating in so far as the adjustment of rates is concerned. I refer to what I choose to call regulation by conference vs. formal proceedings. Much good has been accomplished in the past in this and other states through amicable adjustments effected around the conference table, and I believe that much more is to be accomplished in the future.

Regulation by conference

Since the inception of regulation in California in its present form in 1911 the public, the municipalities, through their representatives, and the public utilities, acting through their officers, have found that the commission and its various experts are at all times ready and willing to discuss complaints or problems and to take such action as may be deemed necessary to adjust expeditiously differences which have arisen. However, it is only within the past few years that the utilities of the state have shown a disposition to meet with the commission in conference with representatives of the public and seriously discuss voluntary rate adjustments. Within the past few years there has been in evidence a wholesome willingness to do this very thing.

By means of such conferences substantial rate reductions have been voluntarily effected by the Pacific Gas & Electric Company, Southern California Edison Company, San Diego Consolidated Gas & Electric Company and by other large electric utilities of the state. I am confident, however, that this method has not been used in many instances where the facts and circumstances fully warranted it. I am of the opinion that certain executives are still somewhat skeptical and loathe to participate in such conferences, especially when a rate proceeding is imminent.

Possibly they are apprehensive lest their willingness to participate in such informal discussions may be misconstrued and taken as evidence of the weakness of the position they may eventually elect to assume, or possibly they fear that they may inadvertently or otherwise disclose facts which may be used against them. If either assumption be correct, I feel certain that they are laboring under a misapprehension.

To my mind conferences of the kind and character I am now discussing, to be productive of the greatest good to all concerned, must be entered into with the distinct understanding that, in the event a satisfactory solution of the problems under discussion is not mutually agreed upon, the positions taken or facts developed by either party shall not militate against them in the final determination of the matter except in so far as those facts may be developed by evidence other than the conference admissions.

I am advised that the American Bar Association has within the past few months appointed a committee for the purpose of studying improvement in procedure before public utility commissions and that the principal investigation to be undertaken is the matter of increased informality in rate proceedings. Ways and means are to be found for increasing the use of such procedure. It is simply another indication of a widespread realization that adjustments by conference are desirable and constitute a wholesome substitute for costly rate litigation.

I do not wish to be understood as advocating the doing away with regulation nor the scrapping of the machinery by which the intent and purpose of the several provisions of the California public utilities act are administered. I believe that through the instrumentality of the commission, the utilities, by the assumption of a proper co-operative attitude, can remedy this situation, which will result in an era of good feeling throughout California and will enable them to exert all their energies toward the rendition of good service, instead of a continual sharpening of pencils and an indulgence in that nerve-wracking, public-relations-destroying propensity sometimes facetiously characterized as the "bankers' complex." But to even approach an approximation of this happy result one concession must be indulged in by the utilities. I refer to that ever-recurring demand for a valuation for rate-fixing purposes predicated in the main upon reproduction cost new with its guilty handmaiden, that unconscionable intangible known as "going concern value."

Reproduction cost an improper basis

Proof of the wisdom of any policy of the commission I think may be justly and righteously judged by the results which through a series of years follow therefrom. The California commission has consistently for a great many years arrived at its valuation of utility properties for rate-making purposes by the use of the historical cost or prudent investment factor. By a liberal allowance for development costs it has practically ignored claims for large going concern value. What has been the effect on the utilities of this policy and practice of the commission?

It has not been the means of forcing a single utility in California into the hands of a receiver. On the contrary, except in cases where other causes intervened, it has maintained the utilities in good business condition. They have steadily expanded and experienced a reasonable degree of prosperity under regulation. This policy on the part of the commission has not frightened capital from the utility field. Development money has at all times been readily attainable and the utilities have experienced but little difficulty in quickly disposing of their numerous security issues. I think I am fully justified in the conclusion, from the results attained, that the commission's policy with respect to valuation has proved to be eminently fair and equitable and has not interfered with natural and normal development of the utilities.

A disposition on the part of the utilities to forego their insistence on a valuation based primarily upon reproduction cost new will impress the people with the conviction that they do not want the pound of flesh, but are willing to accept a valuation based upon the money actually and prudently invested in the undertaking. Prudent investment is a term easily understood by the people and carries with it none of the highly speculative considerations involved in that rather unpopular factor, reproduction cost new.

Why should an electric utility in California contend for reproduction cost new for rate-fixing purposes? There is not an electric utility in this state which, from the standpoint of enlightened self-interest, would attempt to operate its business on rates based upon reproduction

cost new built upon the highly speculative and exorbitant methods of establishing that character of valuation. In my judgment, other forms of competitive power, the potentiality of municipal ownership operation, and the normal economic limitations of the consumers eliminate any possibility of the successful application of an electric rate schedule in California based upon that factor.

In fairness, I might say that the vast majority of the California utilities have rather reluctantly, but in the end graciously, accepted the commission's policy with respect to prudent investment and going concern value and have refrained from seeking relief in the courts. However, there appears to be a growing tendency of late to insist on the full measure of what they conceive to be their technical legal rights under certain decisions of the Supreme Court of the United States, and should this tendency become widespread among California utilities, I would not care to be held accountable for what may in all human probabilities follow.

The tendency in this direction in California is not singular. It is evident in other states. It has been suggested in some quarters that commissions should be given larger appropriations in order that they may go throughout the land and obtain leading experts of the country on valuation problems, such as going concern value, water rights, etc., and in every case prepare a record that will stand assault in the courts and for the commission thus to adopt an attitude of willingness to litigate. This is obviously not the sound way to meet the problem, and if such a policy is to be adopted by some of our Eastern states (as appears to be the case) I am fearful that it will work to the disadvantage of all concerned, the public and the utilities alike.

Legislation not solution

It is but recently that the Legislature of Wisconsin enacted a statute which is designed to enable the regulatory commission to have available unlimited funds with which to fight in exercising regulatory functions. The statute provides that the cost of rate litigation incurred by the commission shall be borne by the respective utilities affected, and says in effect that whenever the commission, in any proceeding, either upon its own motion or upon complaint, makes any accounting investigation or any valuation of property or any investigation of the practices or activities of any public utility, power district or railroad, it is to determine the expense incurred and the company or railroad investigated is required to make payment thereof.

The act further provides that at the end of each fiscal year the commission shall determine its total expenditures during the year and shall assess the same, less payments collected for particular investigations, upon the utilities and railroads subject to its jurisdiction in proportion to their respective gross operating earnings for such year. It is provided, however, that the total amount which may be assessed to the public utilities, power districts, the street and interurban railroads under this authority shall not exceed one-fifth of 1 per cent of the total gross operating revenues of such public utility power district and railroad during such calendar year.

I am apprehensive that the problem cannot be met by legislation and that a statute of this type, designed to enable the purchase of stronger and heavier armor, will but retard the advance of effective regulation.

An electric utility which is allowed its operating expenses, including depreciation and taxes, and a fair return on the amount prudently invested in the properties, which fair return is substantially in excess of the cost of money to the utility, in my judgment has no just cause for complaint.

Voluntary rate reductions

What remedy am I suggesting? Simply this: When the utilities see that their rate of return is exceeding the rate ordinarily allowed by the commission, that they voluntarily work out a reduction and obviate the necessity of action on the part of the commission or the consumers. This is probably an easy way to adjust rates downward, but what if the rate of return falls below that allowed by the commission? Well, it's a poor rule that won't work both ways.

In that event come to the commission, lay your cards on the table, as many of you have done. Present all of the facts reasonably necessary to arrive at a just conclusion. If the commission, after investigation by its engineering and finance departments, finds that your informal showing is correct and that you may unjustly suffer without an increase of rates, I believe it will, in keeping with its well-established policy in the past, call an informal conference, to which will be invited representatives of the consumers, and it will then be determined if by conference and co-operative effort some equitable measure of relief cannot be afforded without the necessity of a long, expensive hearing. This may not under our present law eliminate the necessity for a formal hearing, but it will go a long way toward shortening and softening the formal proceeding.

Regulation of public utilities by state commissions has proved highly successful, at least in California, but the procedure of such regulation as applied to the determination of rates for public utility service might well be changed from one of legal contest to one of open, frank consideration of the problems involved, with the idea on the part of the utilities of sharing with the consumers, through voluntary adjustments in rates, a fair and equitable portion of their earnings, if such be in excess of what may be deemed reasonable.

Formal rate cases, in the majority of instances, are of necessity long-drawn-out proceedings, slow of movement and extremely expensive both to the utilities and to the state. They involve extensive legal and technical preparation and argument and invariably develop into bitter contests, with consequent antagonisms which often partially or wholly nullify the effect of years of effort in the building up of desirable public relations. They also force an unavoidable delay during the pendency of the proceedings of the granting of relief to the party seeking such relief, which is irritating to the patience of all concerned.

No matter what may be the outcome of such proceedings, it is extremely difficult for the average layman or consumer to grasp the full story in all its details and to justify in his mind the tremendous expenditure of time and money involved in these ever-recurring contests. And the loss of time involved is a real loss. It occupies the full time of many months of a substantial portion of the personnel of both utility and state organizations which might be spent in efforts to improve service.

So I say, in all seriousness, that the most obvious im-

provement of the present system of regulation would be the doing away with these extended legal contests and the substitution therefor of voluntary action on the part of the utilities through conferences with the commission whereby and whereunder voluntary rate adjustments may be put into effect from time to time consistent with the maintenance of a reasonable rate of return upon the capital prudently invested. Such action will certainly remove many of the objectionable elements involved in the handling of rate adjustments, will be a powerful factor in the building up of general good will and confidence, will further eliminate the expenditure of large sums of money and time, and will afford prompt relief without undue delay.

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Structural-Shape Conductors Show Increased Efficiencies

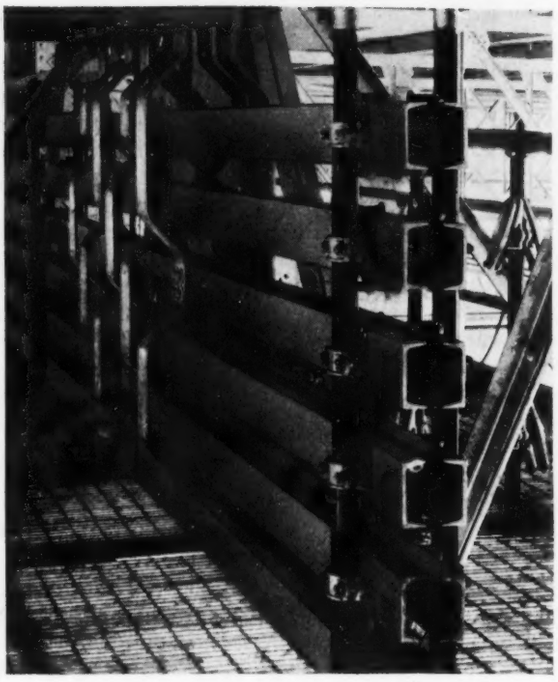
By H. W. PAPST and D. I. BOHN

Engineering Department, Westinghouse Electric & Manufacturing Company, and Electrical Engineer Aluminum Company of America, Respectively

In order to avoid the shortcomings of tubes and bars a new type of conductor consisting of structural shapes has been developed. With tubular bars a limited part of the surface is available for cooling so that they are seldom used for heavy currents. With flat bars the supports must be closely spaced due to the low lateral strength of the section.

Skin effect does not require much consideration in designing conductors for 60-cycle currents below 2,000 amp., but at higher currents its effect is so pronounced as to become a major factor in such design. While tubes are nearly ideal in regard to skin effect and in addition possess excellent mechanical properties, only about half of the surface is available for cooling. Various arrangements of bars are used to obtain a reasonably low skin effect ratio, the "modified hollow square" being one scheme quite extensively used.

The new conductor is designed for currents of about 2,000 to 7,000 amp. at 60 cycles and combines the various desirable properties of both tubes and bars. A split square tube is formed by placing two standard aluminum structural channels facing each other. A comparison of the ratings obtained from heat runs, particularly with the larger channels, shows that the internal surface of the channels is very effective in heat dissipation. Tests for skin effect gave values approximating those for tubes, as might be expected.



Double-circuit 440-volt bus for heavy currents (Alcoa)

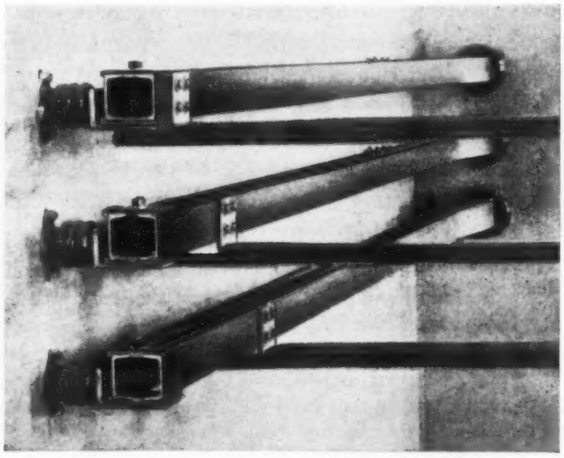
Various types of supports have been employed with the channel construction. They are all designed to permit a free longitudinal expansion movement, the stiffness of channels making this necessary. Ordinarily, a bus run of considerable length may be made without expansion joints unless the channels are of necessity fixed at two or more points. If expansion joints are thus made necessary, aluminum laminations spot welded at the terminals are bolted to the channel webs in the same manner as when bars are used.

Channel Conductor Ratings

For pairs of aluminum channels arranged to form a square. Temperature rise 30 deg. C. over a 40 deg. C. ambient, at 60 cycles.

Size of Web Channel	Thickness	Flange Width	Lb. per Ft. (2 Channels)	Cross Section (2 Channels)	Effective Current Density	Rated Amperes
4	0.180	1.580	3.80	3.14	796	2,500
4	0.247	1.647	4.44	3.68	762	2,800
5	0.325	1.885	6.40	5.28	683	3,600
6	0.437	2.157	9.26	7.64	615	4,700
7	0.524	2.404	12.26	10.14	563	5,800
8	0.579	2.619	15.12	12.50	536	6,700

The mechanical properties of channel permit supports to be spaced at greater intervals than is usually done when bar is used. In general, spacings of 10 to 25 ft. may be employed. If the phases are arranged vertically maximum channel strength is available to resist short circuits. With a horizontal arrangement the two channels may be fastened together at intervals in the span to

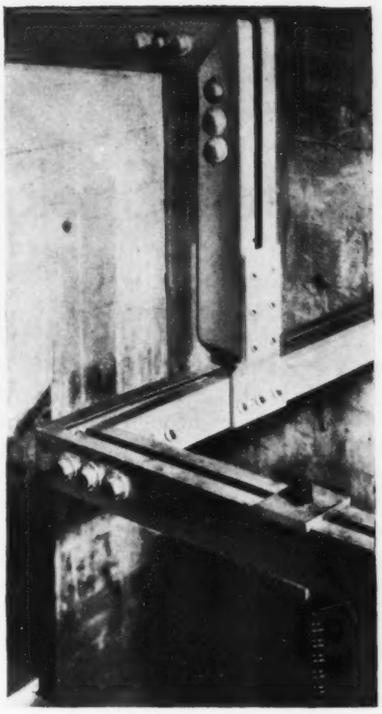


Power station bus using aluminum channels (Chute à Caron)

give, in effect, a box girder, and greatly increase the normal strength in this plane.

Bay spacings in industrial buildings and outdoor substations are in many instances about the same length as the desirable channel conductor span. Extra steel for intermediate supports may be eliminated and a considerable saving results.

In most cases taps to apparatus are made by bolting flat bar to the outside web face. This usually provides sufficient flexibility to take care of expansion movement of the channels. Splices, angles, etc., merely require the bolting of properly shaped splice plates. These plates may be either internal or external, the former being most common because of its neater appearance.



Vertical and horizontal angles are easily made (Chute à Caron)

The reactance of channel conductors approximates that of an equivalent tube. With low-voltage applications, where low reactance is of primary importance, the rigidity of channels permits a phase spacing smaller than would be desirable if bars were employed.

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Motor Control Works Well on Network Voltage*

By E. F. KURTZ

Industrial Engineering Department, General Electric Company, Schenectady, N. Y.

The application of control equipment to 208-volt networks involves two principal questions: First, whether standard 220-volt control devices will operate at 208 volts and, second, what special requirements if any must be met because of the grounded neutral and consolidation of light and power mains.

In considering magnetic control it is important to note that the industrial control standards of the National Electrical Manufacturers' Association require that alternating-current contactors shall close successfully at 15 per cent less than normal voltage. This was approved as an American Standard (July 9, 1925) and is followed by practically all manufacturers. A 208-volt network with plus and minus voltage variation of from 3 to 4 per cent is then well within the range on which contactors designed for 220 volts will close properly.

The temperature rise of contactor coils is reduced by the reduction of voltage since the exciting current is less, thus reducing the copper loss, and the lower flux density reduces the iron losses. Undervoltage devices drop out at a voltage well below 208, so no trouble from this source is experiencd.

It was shown that the line currents of 220-volt motors are increased when operating at 208 volts. The reduced voltage operation is equivalent to a slight overload so far as the control is concerned, but as the control devices listed for general purpose induction motors are capable of carrying overloads as great as the motors can carry, the overload protection for the motor also protects the control.

Thermal overload relays protect the motors and control against injurious heating from increased current caused by either mechanical overload or undervoltage. These relays possess a thermal lag which corresponds to the heat storage capacity of the protected motor. Thus the motor carries the maximum safe load for the maximum safe time in spite of reduced voltage if the relay rating and setting are based on the nameplate data of the motor.

The National Electrical Code for 1930, Sec. 808-A, page 121, states that when protective devices other than fuses are used for the running protection of motors, three-phase, alternating-current motors operating on four-wire, three-phase alternating-current supply systems with neutral grounded or ungrounded shall have an overload unit such as a trip coil, temperature relay, or thermal cut-out in each of any two conductors except the neutral.

Thus the code permits the use of standard three-phase control devices with two-coil overload protection on 208-volt, four-wire, alternating-current networks and similar systems having Y-connected transformer secondaries with grounded neutral. Using two overload trips for motor protection involves a very remote possibility of trouble caused by a ground in a certain portion of the winding, but it is so remote that operating companies have not found it necessary to use more overload protection than is found in the ordinary three-wire, three-phase control devices.

In contrast to the "motor protection" just discussed, the National Electrical Code requires one overcurrent unit in each ungrounded line for "circuit protection." The circuit protective devices are simply intended to protect the branch circuit and its connected load from the dangers attending faults to ground or between phases resulting in current of "short-circuit" magnitude. These overcurrent units are ordinarily placed where the motor branch circuit joins a main feeder or a feeder of larger capacity, with exceptions as provided by the National Electrical Code.

For control, then, it may be said that standard 220-volt, general-purpose control on 208-volt, combined light-and-power alternating-current networks will function properly and the higher current of the motors will not unduly overload the contacts, relays, etc. The contactor coils will operate at a lower temperature rise at the lower voltage. The overload relays will protect the motor and control, but the amount of mechanical overload that can be carried will be reduced somewhat because of the slight increase in normal load current.

*See also "How Motors Perform on 208 Volt Networks," page 958, May 23, 1931, "Electrical World."

Slow Cloud Ionization Confirms Direct-Stroke Theory*

By C. L. FORTESCUE
Consulting Transmission Engineer
Westinghouse Electric & Manufacturing Company

FIELD experiences have given firm support to the theory that the direct stroke rather than the induced stroke is the cause of transmission outages due to lightning. Consideration of the thunder cloud itself and the manner in which electrical energy is stored in it and the mechanism of its discharge in the form of a lightning stroke further confirm the preference for the direct-stroke idea.

The thunder cloud consists of small particles of water vapor, each carrying a minute charge of electricity. If a free negative charge is present it attaches itself to a particle of vapor and thereby loses mobility. A thunder cloud retains its charge by reason of the fact that the particles of water vapor repeal each other and, since the size of the particles is maintained constant, remain suspended in the air by the action of upward components of the air currents.

Since there are very few free ions in the cloud atmosphere and since the mobility of the charged moisture particles is very small, the only way such a volume can be discharged is by ionization. This process in a cloud atmosphere may be extremely slow. During the formation of the lightning streamer very little current is drawn from the cloud, and therefore the volume of cloud atmosphere required to be ionized is small. As the head of the streamer progresses by ionizing the air space in front of it, a space charge of requisite value must be built up and maintained. This ionization of air requires energy and time. Since the energy must be obtained from the cloud itself, the rate at which the point of the streamer will travel will be governed by the rate at which cloud ionization can release energy.

Even if it were assumed that ionization streamers inside the cloud atmosphere could form with the velocity of light, it would require 10 microseconds to discharge completely a cloud volume 1 mile in diameter. However, the speed of formation of streamers is much slower than the velocity of light, probably being not more than one-twentieth that value as determined from time lag measurements of sphere gap breakdown. To discharge completely a spherical volume 1 mile in diameter would therefore take at least 105 microseconds. If a reflection from the ground over the lightning channel is considered, 5 microseconds should be added to the above values.

Some streamers have been noted which never reach ground, as the charge in the cloud is not sufficient to maintain and propagate the streamers. It may therefore be inferred that lightning strokes to earth or to a structure will vary their severity over a wide range, depending upon the amount of energy the cloud is capable of discharging through the lightning channel.

The energy in the streamer itself, until it reaches ground, a transmission line or any structure, is mainly potential energy, because the motion of the charges in the channel is relatively slow as compared to the velocity of light and because the currents required to produce ionization are relatively small. When the earth or a structure is reached by the streamer its potential energy is instantly changed to kinetic energy and a current wave moving at the velocity of light flows into the earth or the structure. Negative reflections pass up the lightning channel, increasing the discharge current in the channel as they proceed, until they reach the cloud, where they increase the gradient in the cloud atmosphere, causing the ionization streamers to penetrate further into the cloud volume and thus tapping more of the cloud energy to supply current to the channel. As the volume of ionization extends within the body of the cloud the rate of discharge gradually decreases, until the point is reached where the available energy is insufficient to stabilize the channel from cloud to earth and the current ceases to flow.

Discharge time precludes induced voltage

Thus it is seen that it is physically impossible for a cloud to discharge to earth in short enough time to give very high induced voltages; in fact, the probable minimum limit for discharging 20 coulombs of the cloud charge is of the order of 100 microseconds or more. It should further be noted that one discharge does not necessarily empty the cloud of its discharge, and that after the first discharge the portion of the cloud that is emptied will become recharged again by diffusion from the main body of the cloud, and a second, third or fourth stroke may follow the first over the same path at time intervals of a fraction of a second. As a consequence of the observations discussed above and the theoretical analysis of the problem a conclusion has been reached pretty unanimously by all engaged in this lightning work that for high-voltage lines the main cause for outages due to lightning, and probably the only cause, is a direct stroke to the line or ground wire.

The practical consequences of this deduction are very far reaching, since we know now that we have to protect against extremely high lightning potentials, of the order of 15,000 kv. When a severe lightning stroke strikes a line its potential is released in the form of a steep surge, which passes into the line in conformance with the laws limiting surges, and at the point of stroke the surge potential may be of the order of 15,000 kv.; the

**Abstracted from paper prsented before A.I.E.E. meeting in Raleigh, N. C.*

actual potential on the line will depend upon its surge impedance.

Ground wire must be elevated

One of the primary requisites of ground wire protection therefore is that the ground wire shall always interpose itself as a shield against oncoming strokes. This requires certain requirements in the configuration of ground wire and line wire so as to be sure that the ground wire will always be interposed as a shield against the oncoming stroke to protect the line wire. In order to get the proper shielding effect it is necessary to raise the ground wire to a considerable height above the level of the nearest line wires. But there is a further reason for this, and that is that the lightning stroke may take place in the middle of the span, in which case the potential difference between the ground wire and the line will be limited only by the surge impedance of the ground wires, which at this point is quite high. Consequently there will be a high potential surge of the same order as the lightning stroke potential set up in the ground wire and this surge will last until reflection takes place at the adjacent towers and the reflected wave reaches the point of the stroke, which in general is an interval of time of the order of one microsecond.

During its progress over the ground wire the surge induces a corresponding potential on the line wire through its mutual surge impedance coupling with the line wire. This will reduce the actual difference of potential between ground wire and line wire by an amount depending upon the mutual coupling, which, however, is usually of the order of one-third or less. Consequently, it will be necessary at the middle of the span to have spacing enough between line wire and ground wire to prevent a side flash between the ground wire and line wire due to this potential, which lasts for an interval of one microsecond or so. We have estimated that for the more severe lightning strokes a clearance of something like 45 ft. will be necessary where the spans are 1,000 ft. long. Using this clearance, if we allow 10 ft. for the difference between the maximum sags of ground wire and line wire, you will readily arrive at 35 ft. as the approximate vertical clearance at the tower.

Those of you who have been accustomed to the use of ground wires in the past will feel that these clearances are excessive, but when you reflect that the actual records of lightning hitting a line and also side flashing 25 ft. to a neighboring telephone line, in spite of the fact that the full potential of the lightning stroke had not developed due to the flashover of the line itself, you will realize that these clearances are not excessive for an important line such as the 220-kv. lines that have been built in certain parts of the country.

It has been remarked to me at times that there have been no records of lightning stroke to midspan, but the evidence in this case has been overshadowed by the fact that when a dynamic arc forms it almost invariably forms at the tower, in spite of the fact that the lightning stroke may have taken place at the middle of the span. There are few exceptions that we have noted recently where the actual arc took place in the span, the reason for this being that the arc at midspan is usually longer than the arc at the tower. Since arcs have negative characteristics, the shorter arc will be maintained and the other will extinguish, thus the pittings and other marks left by the arcs by which such flashovers are identified will be found only at the towers.

It may be well to state again that it is probable that the potential of the lightning stroke varies over a rather wide range, consequently the surges that are produced by these strokes will also vary over a considerable range, and it is probable that the potential of the strokes and their frequency follows some probability law so that the extremely high strokes are probably comparatively rare, while the medium strokes are more frequent, and the lower value strokes also become rarer. Consequently, the problem of protecting transmission lines is in reality an economic one, the amount of protection being determined by the importance of the line, or, in other words, by the cost of an outage. This figure is hard to determine, since there is very little information about the relative frequency of lightning strokes of different potentials, but its approximate value may be obtained as a result of experience.

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Group Resistances of Ground Rods

By H. B. DWIGHT

Massachusetts Institute of Technology and New England Power Engineering & Service Corporation, Boston, Mass.

The resistance to earth of a group of ground rods connected together depends, first, on the resistivity of the earth and, second, on the grouping of the rods. In this paper are given sets of curves for obtaining the effect of multiple rods.

Before installing or specifying ground rods, it is frequently advisable to make a number of measurements of earth resistivity in the vicinity of a station by tests on temporary rods. The resistance of a single ground rod is often too high to be conveniently measured with the instruments available. When the test is made on more than one rod Figs. 1 and 2 may be used to show the earth

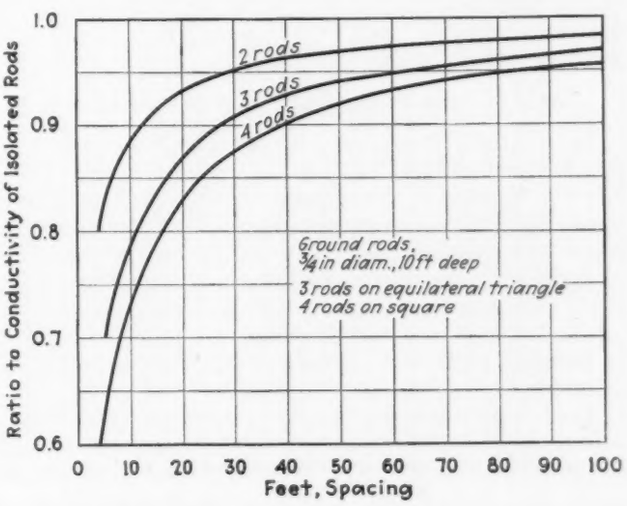


Fig. 1—More rods, less spacing reduce ground resistance

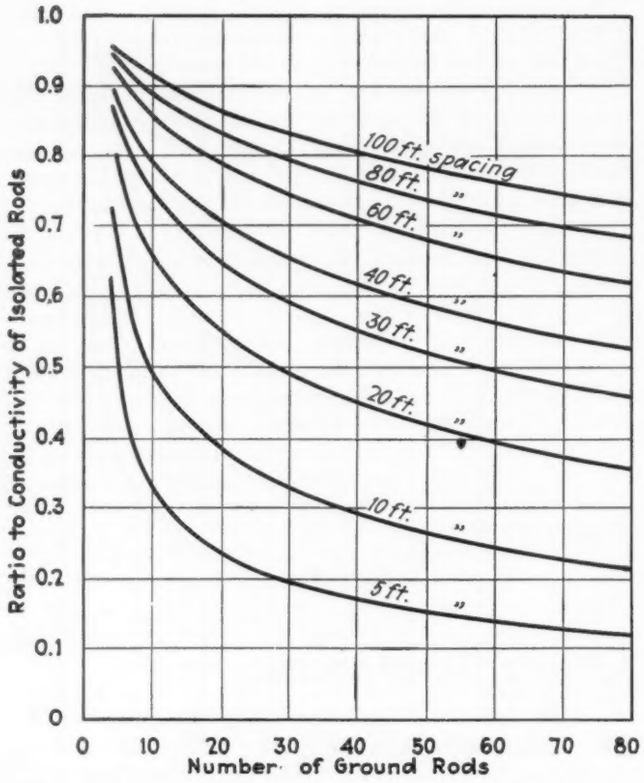


Fig. 2—Increased spacing more effective than multiplying rods at small spacing

resistivity in terms of isolated rods. The average value of earth resistivity in terms of this practical unit—that is, in terms of the resistance of an isolated rod—should be taken for the purpose of computing the resistance to ground of the complete group of rods. For this purpose Fig. 2 or Fig. 3 may be used.

One of the most common troubles in arranging a group of ground rods to have a certain desired low resistance is the use of an insufficient area of ground. Fig. 3 has been drawn up to show the lowest resistance that can be obtained from a given area, even if it contains a very large number of ground rods. This information often is of value, as it may save one from the wasteful attempt of putting additional ground rods in an area which could not give the desired low resistance even if an infinite number of rods were used, or if the area were covered with a buried copper sheet.

Area often more important than number of rods

If 25 ground rods are distributed over a square area of 5,000 sq.ft. (18-ft. spacing), it is shown by Fig. 3 that the resistance is 1.25 times the resistance of an infinite number of rods in the same area. Therefore, no matter what the resistance in ohms of the 25 rods may be, if it is desired to have less than 80 per cent of that resistance there is no use in putting more rods in the area of 5,000 sq.ft., but it is necessary to utilize a larger area. Also, if there are more than ten rods 10 ft. deep there is no use in having closer than 10-ft. spacing.

It is usually desirable not only to use the ground area effectively but to utilize the rods to advantage, since they represent considerable cost. If it is desired that the rods be at least 70 per cent as effective as they would be if isolated—that is, that they have at least 70 per cent of the conductivity of isolated rods—it is seen from Figs. 2 and 3 that it is necessary to use over 30 ft. spacing for sixteen rods in a square area, over 40 ft. spacing for 25 rods and over 60 ft. spacing for 49 rods.

The curves give approximate results and are based on uniform distribution of ground rods in square areas, the boundary of the area running though the outer rods. The computations are based on 10-ft. ground rods $\frac{3}{4}$ in. in diameter. The curves are from the paper by the writer on "Calculation of Resistances to Ground and of Capacitance," *Journal of Mathematics and Physics*, Cambridge, Mass., January, 1931, page 50, where the calculations on which they depend are described.

Connecting to line ground lowers resistance

An effective way to lower the resistance to ground for a station is to connect to the ground system the ground wires of any transmission lines coming into the station. This makes the dimensions of the group of ground rods very large, for the group includes the tower footings. It is difficult to measure or calculate the resistance to ground of such a group. On account of the ground conductors of the transmission lines being of high-resistance steel the curves presented in this article do not apply.

The 60-cycle resistance of the earth path between two stations, when there is no metallic ground conductor, is the sum of the resistances to earth of the stations plus 1/10 ohm per mile for the distance between them measured along the transmission line. Current at commercial frequency in the earth is for the most part confined to a region within one mile of the power line. The alternating-current calculation for such a path was given by J. R. Carson in the *Bell System Technical Journal*, October, 1926.

When there is an overhead ground conductor its impedance is in parallel with that of the earth path, but since it is grounded at frequent intervals a simple calculation is not applicable unless the resistance to ground of the stations is very low.

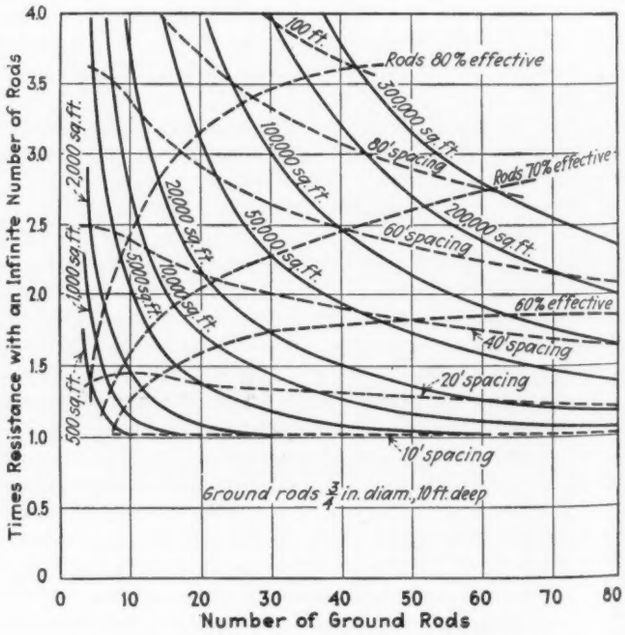


Fig. 3—Increased area often the only solution

There is no gain in using more than ten rods when they are 10 ft. deep on 10-ft. spacing

Railroad Saves Six Times Electric Heat Cost

By WIRT S. SCOTT

Special Representative Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

THE savings accomplished in the use of electric heating for the greater part are characteristic of electric heating rather than of the particular industry using it. At the Norfolk & Western Railway shops, Roanoke, Va., there are many successful applications of electric heating, each being typical of the general application, such as the heat treatment of tools, steel castings, babbitting of bearing, core baking, etc.

A study was made of the major heat-treating operations, with the assistance of the personnel of the Norfolk & Western Railway, and figures arrived at, and agreed upon, as conservatively representing the annual savings by virtue of electric heating. Power cost $17,805 in one year and the savings credited to its use in electric heat amount to more than $100,000.

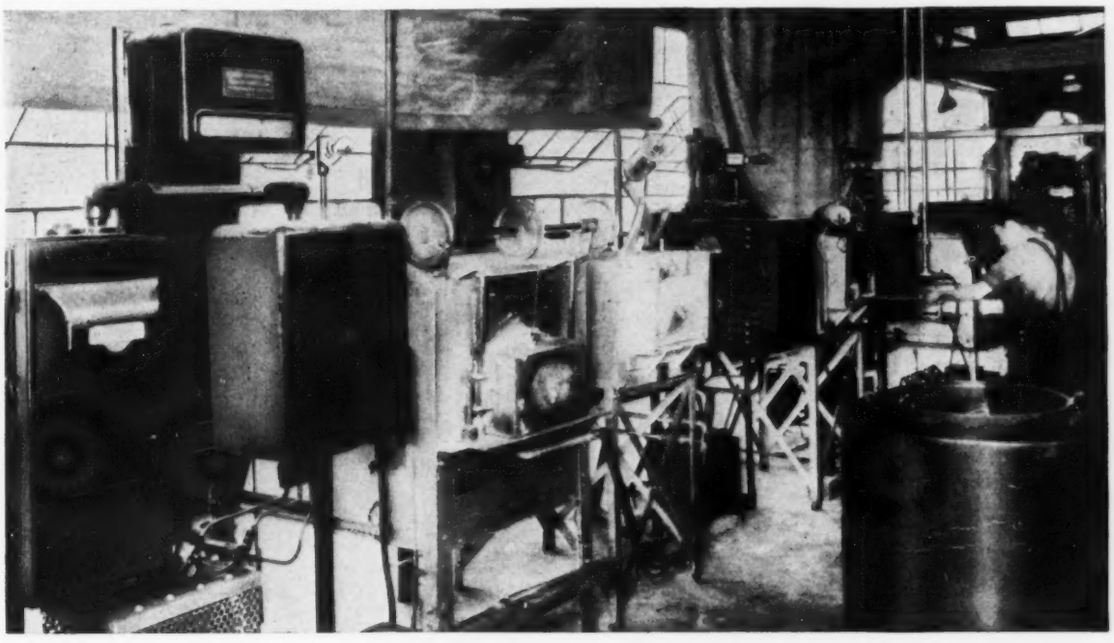
The Roanoke shops are not yet completely electrified and their problem is similar to that of other companies, that of financing the expenditure. They now know from experience that electric heating is economical, accurate, dependable and is a modern tool for a modern plant.

In this department there are heat-treated high-speed and carbon steel tools such as are used in many large machine shops where a wide variety of work is being done. The furnace equipment includes a preheating furnace for high-speed steel, 8 kw. capacity; a hardening furnace for carbon steel, 13 kw. capacity, and a hardening furnace for high-speed steel, 30 kw. capacity. The preheating furnace is also used as a tempering furnace.

Since the adoption of electric heat all guesswork has been eliminated. The exactness of heat treatment has been reflected in the increased life of the tools. As all the tools pass through the tool-grinding department, an investigation was undertaken to determine the tangible results of electric heat treatment in that department. A record secured in connection with high-speed steel tools showed that the tool cost had decreased 25 per cent and that the life of the electrically heat-treated tools had been increased one-third. The older and more experienced machinists reported increased life of tools of anywhere from 30 to 50 per cent.

Saving in labor in grinding department per month	$291.20
Saving in tool steel per month	280.00
Total monthly saving	$571.20
Power cost, 6,250 kw.-hr. per month	50.00

In the maintenance of locomotives, there are a large number of parts to be carburized, such as wristpins and



Tools tempered and hardened here

Low carbon steels tempered and high-speed steels hardened in furnaces at temperature from 300 to 2,400 deg. F.

Electrically heated tin bath holds brasses until ready for babbitt

bushings, equalizer bushings, split side rod bushings, brake pins, spring rigging pins, knuckle pins, die blocks and die block pins. All of these parts are placed in nickel chromium carburizing boxes and packed with crushed bone.

The parts are made of low carbon steel so as to give maximum toughness, and then given a high carbon case of $\frac{3}{64}$ in. for maximum surface wear. The heat treating is done at a temperature of 1,650 deg. F. Two electric furnaces are available, each having a rating of 120 kw. capacity, with an effective hearth area 42 in. wide, 56 in. long, 20 in. high.

A test made on one of the furnaces to determine the heating characteristics and power consumption showed:

Net pounds of work	1,436
Carburizing boxes, pounds	1,148
Crushed bone, pounds	505
Total gross weight, pounds	3,089
Furnace temperature at start, deg. F	860
Operating temperature, deg. F	1,650
Time in	5 p.m.
Time out	6:10 a.m.
Time for furnace thermocouples to reach 1,650 deg. F	2 hours 45 minutes
Time furnace is held at 1,650 deg. F	10 hours 25 minutes
Total time	13 hours 10 minutes
Kilowatt-hours consumed in reaching 1,650 deg. F	328
Kilowatt-hours consumed after reaching 1,650 deg. F	400
Total kilowatt-hours consumed	728
Gross pounds of material per kilowatt-hour	4.25
Net pounds of work carburized per kilowatt-hour	1.97
Cost of power per charge, at $0.008 per kilowatt-hour	$5.828
Net cost of power per pound of material carburized	$0.00406

Due to the much greater exactness of heat treatment resulting from the use of the electric furnace, it was found that the useful life of many of the major pieces of all the carburized parts has been more than doubled. This has resulted in less replacements of such worn parts, a very substantial saving.

On the basis of twenty charges a month and 1,450 lb. of material per charge the production would be 29,000 lb. per month, which would be made up of approximately 9,000 lb. of bushings, 18,000 lb. of pins and 2,000 lb. of miscellaneous products. The values of these parts are as follows:

9,000 lb. bushings at $0.2932 per lb. for manufacturing	$2,628.80
9,000 lb. bushings at $0.20 per lb. for installation	1,800.00
18,000 lb. pins at $0.0877 per lb. for manufacturing	1,578.60
Total value per month	$6,007.40

Twenty-five per cent of $6,007.40, or, roughly, $1,500 per month, was found to represent the minimum net savings, using electric heat, for pins and bushings. The cost of heat treating these parts, a total of 2,700 lb., was $109.62. With a saving by extended life on the remaining 2,000 lb. heat treated in proportion to that of pins and bushings, the total monthly savings and expense will be:

Total net savings per month	$1,560.00
Total cost for electric heat treatment	117.74

The savings in the above case is thirteen times the cost of electric power. That the life of the carburized parts has been greatly increased is also shown by the fact that one electric furnace is now handling the repair parts for which two were originally required.

Annealing steel castings

The Roanoke shops first installed a coke-fired furnace for the heat treatment of steel castings, and later this furnace was replaced with one heated with oil. With the coke furnace, whenever the doors were opened to add more fuel, the temperature within the furnace chamber would drop from 75 to 100 deg. With the oil-fired furnace, which was next installed, a series of tests disclosed the fact that the temperature at all parts within the furnace were nowhere near the same. A great non-uniformity of physical properties was disclosed even within the same casting, the bottom part of which would be at one temperature and the top at some other temperature.

A decision was made to replace the oil-fired furnace with an electric furnace, solely on the basis of producing the kind of casting having the physical properties the designing engineers had a right to expect. The new electric annealing furnace was installed in 1927. It has an electrical capacity of 540 kw., a charge capacity of 20 tons maximum, 12 tons average, and a loading space on the car 7 ft. wide, 14 ft. long and 5 ft. high.

The castings are given a normalizing heat treatment, which consists in heating the castings at a temperature of 1,650 deg. F. until thoroughly saturated, and then pulling the car out into the air for an air quench. The electric furnace heats uniformly top and bottom, end to end, and by allowing one hour soaking period per inch of the heaviest cross-section of the casting, from the time the temperature of 1,650 deg. is reached, it has been found that the entire charge will be thoroughly heated.

The car type furnace is operated from four to five nights each week. With a charge as above described, the furnace will require nine hours to reach 1,650 deg. F. and the temperature held at 1,650 for six hours, making a fifteen-hour heating cycle.

Some parts, such as engine frames, are given a double heat treatment for the purpose of giving such members greater ductility. This consists in heating the charge at 1,650 deg. F. for ten hours, remove and allow to cool until black, reheat to 1,250 deg. for ten hours and remove into the air.

In addition to securing a properly annealed casting, the outstanding result was the decreased cost of machining the castings. Workmen in the machine shop praised the electric annealing furnace very highly. It is seldom that a hard spot is now encountered, the breakage of tools is much less, more cuts are obtainable, and the steel has a much better grain or texture.

As near as could be determined, the machining costs have been decreased 10 per cent since the castings are electrically annealed. There are 250 machinists employed, with 50 per cent of these on steel castings.

Machinists on steel castings	125
Hourly cost	$100.00
Monthly cost	$20,800.00
Savings over previous cost, per cent	10
Previous cost, based on present production	$23,200.00
Net monthly savings in labor for machining	2,400.00

For a 13-ton charge, with the furnace started comparatively cold, with the current having been cut off for 32 hours, the power consumption was as follows:

	Kilowatt-hours
Power required to reach 1,650 deg F	4,860
Power required after reaching 1,650 deg. F.	1,620
Total power required	6,480
Consumption per ton	500

A second test charge was heat treated, the charge weighing 20 tons and consisting of very heavy castings, such as locomotive driving wheels and frames. The operating data are as follows:

Total weight of charge, lb		40,211
	Hours	Min.
Time required to heat charge from atmospheric temperature to 1,650 deg. F	11	15
Time required for soaking charge at 1,650 deg. F	9	..
Total time of heating cycle	20	15
Kilowatt-hours for heating up charge (11¼ hours at 512 kw. per hour)		5,760
Kilowatt-hours for soaking charge		2,000
Total kilowatt-hours consumed		7,760
Total pounds, annealed per kilowatt-hour		3.18
Kilowatt-hours consumed per ton		392

Assuming a conservative estimate of 450 kw.-hr. per ton on a monthly basis of a production of 170 tons of steel casting annealed, the operating cost will be as follows:

Basic power cost per kilowatt-hour	$0.008
Tons per month	170
Kilowatt-hours per ton	450
Power cost per ton, average	$3.60
Power cost per month	$612.00

Using fuel-fired furnaces, it was necessary to have a man on duty continuously to look after the furnace. With electric heat, it has been possible to dispense with such help or service, since the only attention required is on the part of the night watchman, who punches a clock alongside the control panel for the electric furnace, and all he has to do is to note if the indicating lamps are burning. This saving in labor is $118.50 per month.

The monthly saving in machining of steel castings ($2,400) added to the monthly saving in labor of attending furnace ($118.50) gives a total monthly saving of $2,518.50 for a monthly cost of electricity power of $612.

The babbitting department process consists in melting down the babbitt from the old journal bearings, machining and tinning the brasses, babbitting and milling the bearing.

The worn-out journal bearings coming into the department are delivered in a truck alongside an electrically heated rectangular melting pot, 20 in. wide, 54 in. long, 18 in. deep, which is heated with five 10-kw. immersion heaters. The temperature of the bath is regulated automatically at 700 deg. F. The brasses are placed directly in the bath, and when the level of the bath rises near the top of the vessel, the babbit is ladled out into molds, producing pigs weighing 80 lb. each.

From 400 to 500 worn-out bearings are melted down each day of eight hours' operation. After each brass is removed from the bath it is thorougly brushed with an air-driven revolving brush and then inspected for cracks, flaws or any defects which would make it unsuited for further use. Fifty per cent of the brasses are thus discarded and scrapped. Those passing inspection are placed in a truck and conveyed to a double milling machine, operated by two men, who mill out the brasses so as to obtain a bright surface for the tinning of the bearing.

The tin pot is also rectangular, 20 in. wide, 30 in. long, 18 in. deep, and heated with four 7½-kw. immersion units, having automatic control. The brasses are swabbed with muriatic acid, placed in the tin bath and kept in there in readiness for receiving the babbitt.

The brasses are removed from the tinning pot in pairs, placed on a mandrel and held in place by means of push rods operated through compressed air cylinders and the babbitt ladled into the brasses. The babbitt pot is of the circular type, 21 in. in diameter and 19 in. deep, 22-kw. capacity, with automatic temperature control.

After the bearings are poured, they are smoothed off and then placed in a finishing milling machine, where they are bored out to an exact size.

The life of a bearing is affected tremendously by the temperature to which the babbitt is heated. A variation in temperature of 200 deg. from normal will result in a bearing life of only one-fifth of the life that should be obtained under proper temperature conditions. Overheating the babbitt, followed by pouring at the proper temperature, is as injurious as pouring at the overheated temperature.

With the coke fuel previously used a wide variation in temperature resulted. Since using electric heat the temperature is automatically maintained at a predetermined point, and it is conservatively estimated that the bearing life has been more than doubled.

With a production of 5,000 bearings a month, at a labor cost of $988, the average labor cost per bearing is $0.1925 in the babbitting department. There is used an average of 1,200 lb. of new babbitt metal per day, or 27,200 lb. a month, at $0.25 per pound, making a metal cost of $6,800, or $1.36 per bearing. The total labor and material cost is $1.55 per bearing.

Using fuel-fired furnaces for melting the babbitt, it is estimated that the percentage of worn-out bearings for various causes would be distributed as shown in the following:

	Per Cent
General wear and tear	50
Improper lubrication	25
Poor babbitting	25

An analysis of the above would indicated that 25 per cent of the bearings may be defective due to not being poured at the proper temperature, and that 75 per cent may fail due to wear or tear or improper lubrication even before they have a chance to wear out. The savings that

may be said to be effected directly by the babbitting will be 12.5 per cent of the total failure.

0.125x5,000 = 625 bearings a month
625x$1.55 = $968.75 per month

Each of the 625 bearings worn out prematurely must be replaced in the car, at an average cost of $0.77 per bearing, or a total cost of $481.25 per month for labor of replacing bearings.

Net monthly savings due to increased life of bearings:

Cost of bearings	$968.75
Installation	481.25
Total	$1,450.00
Cost of electric power 19,000 kw.-hr. per month	$152.00

The production of a better babbitt and longer life of bearing is worth 9.6 times the cost of the electric power.

Core baking

The use of electricity on a large scale for heating core-baking ovens was of unusual interest since it must be admitted that this form of heat for core baking has not received general acceptance to the same extent that it has in other applications. There are three large electrically heated core-baking ovens in operation, each oven being as follows:

	Ft.	In.
Width	8	6
Depth	17	6
Height	11	6

lectrical capacity, 185 kw., three phase, 60 cycle, 220 volts. The ovens are truck operated, each oven holding two trucks 6 ft. wide by 8 ft. long.

Cores for the most part are quite large, such as for locomotive parts. The loss of such cores or the castings represent an appreciable sum of money. An investigation was made to determine if any evidence was available as to actual savings since using electric heat.

Using coke-fired core baking ovens, the following difficulties were found to be present:

1. Had to depend on labor to fire furnace and attempt some sort of temperature control.
2. Oven was either too hot or not hot enough.
3. Most cores were underbaked.
4. Some cores would be overbaked.
5. One part of the oven would be too hot, while another part would be too cold.
6. Occasionally the entire day's work of a core maker would be lost due to burned cores which caused the cores to fall to pieces. This might be a rush repair job, and it might be important to save every hour possible.
7. Castings were repeatedly lost, due to blowholes caused by green or partly baked cores. These small holes, caused by the escape of excess vapor, may not show up until the casting was being machined, and sometimes the major part of the machining had been done before the defect could be discovered.

Since using electric heat an improvement has been noted in the castings. The difficulty of blowholes due to underbaked cores has been completely eliminated. Another source of defective castings was the burning of the cores, resulting in the core flaking off or washed away by the molten metal, which also is now past history.

An average charge of cores per oven will weigh 9,000 lb. and the power consumption 800-kw.-hr. per bake. At a cost of 8 mills, the power cost is $6.40 per oven per bake, or $19.20 for the three ovens. The average value of the cores for the three ovens is $150, including labor and material, and for the steel castings annealed and sand blasted $2,000.

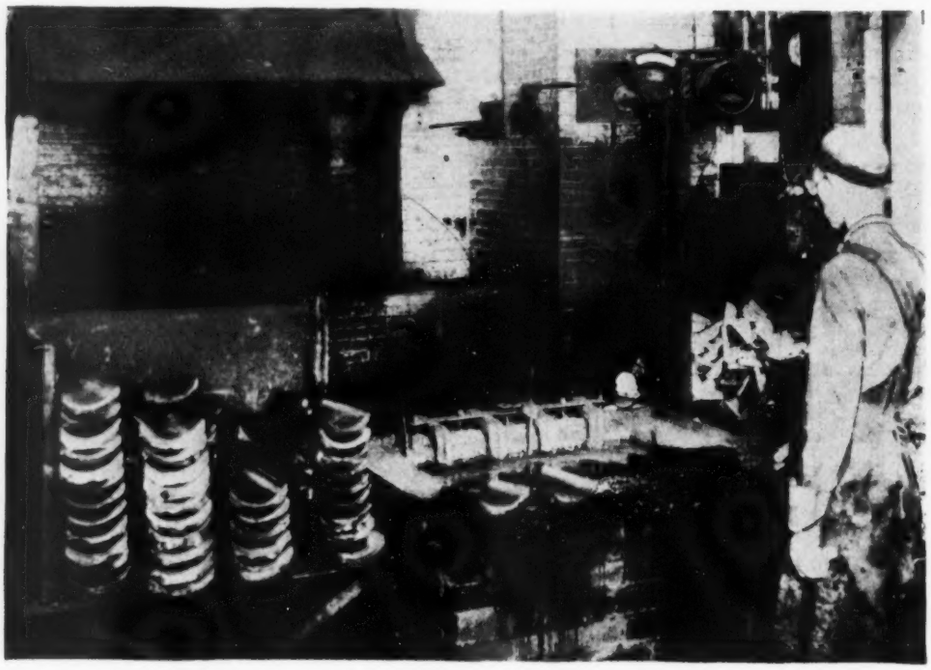
The saving in loss of cores is placed at 3 per cent, or $4.50 per day, and the saving in the loss in steel castings at 1½ per cent, or $30 a day.

Using fuel-fired ovens, the labor of 75 per cent of one man's time was required for firing and watching the ovens. This amounts to six hours at 57 cents per hour, or $3.42 per day.

A summary of the total annual savings for the three electric core-baking ovens show the following:

Savings due to spoiled cores	$1,350.00
Saving in steel castings	9,000.00
Labor for attending ovens	1,026.00
Total gross savings	$11,376.00
Power cost	5,760.00
Net savings per year	5,636.00

In the electrical repair department there is installed an electric oven for baking varnish on electrical coils, such as armatures, field coils, rotors, stators and locomotive headlight generators. These parts, when brought in for repairs, are given a final treatment of an impregnating varnish and then baked in an electric oven from 24 to 72 hours at a temperature of 250 deg. F. An exhauster set is used for forced ventilation and for recirculating.



Ten to twenty tons of steel castings normalized

Saddles, front foot plates, cylinder heads, driving boxes, chafing blocks, truck boxes, valve-head extensions and miscellaneous parts are handled in one batch.

The useful lives of the coils impregnated and baked in the electric oven had been extended to double the life prior to the adoption of the method. Small coils are dipped in the varnish, allowed to drain and hung up in the oven for baking. Large coils are sprayed with a spray gun and run into the oven on a truck. All coils are thoroughly baked out before being impregnated.

The principal cause of defective windings is due to the gradual deterioration of the insulation, caused by the coils becoming porous, permitting dust and dirt particles to filter through the insulation, and eventually short circuit or ground the wiring.

Electrical coils imbedded in slots tend to chafe and wear away the insulation unless rigidly held in place. Even stationary coils are subject to such damage since the electrical shocks imposed on them tend to cause them to fly out of position. Impregnating such coils with a resilient gum and baking them thoroughly in the electric oven under proper conditions has resulted in doubling the useful life of such coils in regular service.

In the winding department there are four armature winders and four laborers at a total labor cost of $1,456 per month. Inasmuch as the life of such coils has been increased 100 per cent since using the baking oven, the amount of labor that would be required in the winding department would have amounted to $2,912 a month, or double the present cost, or $17,472 per year, net saving.

Electric Heat Costs and Savings in Railway Shop

Application	Power Cost, per Year	Total Savings per Year
Babbitting of bearings	$1,824.00	$17,400.00
Armature and coil baking	864.00	17,472.00
Tool heat treating	600.00	6,854.00
Carburizing	1,413.00	18,720.00
Core baking	5,760.00	11,376.00
Annealing steel castings	7,344.00	30,222.00
Grand totals	$17,805.00	$102,044.00

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Water Heaters Rented to Householders by Utility for $1 per Month

Endeavoring to build water-heating load at a more rapid rate than by outright sale of heaters, the Northwestern Electric Company, Portland, Ore., has in operation a rental plan which is proving satisfactory. Any electric range customer who owns his home may lease a water-heater installation from the company for $1 per month rental providing he signs a contract agreeing to take and pay for flat rate water-heating service for 36 months under the regular tariff of $5 per kilowatt-month for unrestricted service, or $3.50 per kilowatt-month using a peak limiter set to cut out the heater when any two or more range elements are in use. A clamp-on booster connected to the range meter is a part of the standard installation, as may be seen from the accompanying diagram.

At any time after twelve payments have been made the customer may purchase the installation if he desires and 75 per cent of all rental paid in will be credited toward the total purchase price of $105. Ten months are allowed on the balance. If the rental plan is continued indefinitely the installation becomes the property of the consumer after an amount equal to 25 per cent more than $105 has been paid in. This would require about eleven years. Lease contracts are recorded with the county. The company maintains the installation. Under this plan about 150 installations have been made since August, 1930.

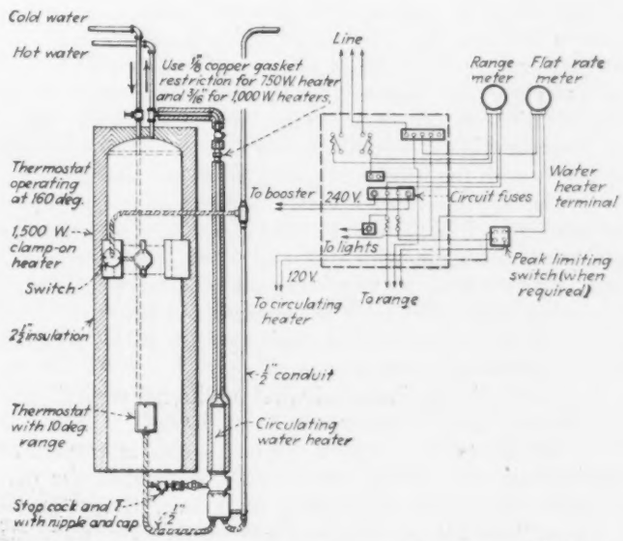
Three other plans are offered customers, as follows:

1. Outright sale for $105 of the same installation covered under lease contracts.

2. Straight circulation type heater without the clamp-on booster, installed complete for $60.

3. Self-contained unit type interior circulation heater —30-gal. tank, $170 installed; 52-gal. tank, $185 installed.

The usual installation consists of a 70-watt flat rate circulation heater with a 1,500-watt booster on the meter. A thermostat is placed near the bottom of the tank to cut out the flat rate heater when the tank is completely filled with hot water. The booster heater is thermostatically controlled, and if the customer does not desire to have it float on the line a manual switch is added. Check meters show the consumption of flat rate heaters to run from 400 to 500 kw.-hr. per month. For this service the customer pays $2.62 for restricted use or $3.50 per month for unlimited service on a 750-watt heater. No accurate data is available on consumption of booster heaters, but it is known that the over-all cost of hot-water service is sufficiently low to attract business in good volume.



Method of making two-unit water heater installation using clamp-on booster to supplement flat rate circulation heater

Finds Autonomy Essential to Good Public Relations

Based on an interview with

WILLIAM E. WOOD

Vice-President Engineers Public Service Company

Recently Engineers Public Service Company launched a new management unit and modified its management policy. One of the company's executives was asked what was the meaning and significance of the changes. The accompanying comments are based on the results of that interview.

TWO very definite conclusions based on years of utility operation induced Engineers Public Service Company recently to inaugurate a new management unit and a new management policy. One of these conclusions is that thoroughly capable local managers can be developed only if they are granted a large measure of responsibility and autonomy. The other is that only by developing such local managers can satisfactory public relations be permanently achieved.

Of course many of America's mammoth utility systems espouse the same or a similar theory and policy of management. There is nothing essentially new in it. But the fact that many local utilities are manned by officers who are paid merely to carry out orders—who are not regarded by their community as part of it and as working for its interest, but as the paid agents of some metropolitan banking group—makes the question one of the most important facing the industry today. Even a casual survey of the industry discloses the fact that public relations are generally satisfactory where the local manager is responsible and responsive, and very often not where conditions are otherwise.

Not necessarily full autonomy

Obviously an unlimited degree of autonomy is not always feasible. The degree to which it can be extended to local managers in the Engineers Public Service system, as elsewhere, is measured by the capacity of the local organization to accept it. One of the essential duties of the supervisory organization is to keep closely enough in touch with the affairs of subsidiaries to determine the degree of autonomy each local organization is competent to assume. Final responsibilities in basic matters of policy must remain with the parent or supervisory company. Those matters which cannot be delegated to local operating companies may be summarized thus:

1. The determination of basic policies to be adopted by the operating companies.
2. The final decision as to what additional capital shall be invested in the company.
3. The financial policy of the companies in respect to fundamental accounting; the raising of capital; the distribution of earnings, including, of course, dividends.

These three responsibilities are inherently the functions and responsibilities of owners. They cannot avoid them. If they are delegated to the operating organizations and the policies adopted prove unsound the responsibility is still with the owners. In the case of Engineers Public Service the exercise of these three functions is the principal duty of the newly formed supervisory company.

But the final responsibility is not the only responsibility. That final decisions must rest with the supervisory unit by no means relieves the operating company of the obligation to keep its supervisors informed constantly on its recommendations and suggestions, supported by reasons therefor. In this way the local manager develops and assumes more and more responsibility as he sees his suggestion adopted.

One thing the local manager must have before him is the object—in fact, the justification—for the very existence of the business as a private enterprise. Apparently its control by private citizens needs justification in the opinion of a growing proportion of the population. And the counter-charge that these opinions are held only by theorists and political capital makers in no way answers the problem. Serious thinkers here and abroad are more and more weighing the merits of public and even communal ownership. The trend of social evolution is unmistakably in the direction of demanding that private enterprise justify itself. The only thing that will insure the continuation of private ownership and operation of public utilities is for the industry to be able to win and hold the confidence of a substantial majority of the people. There is ample evidence that public temper is not disposed to permit of an attitude of indifference to public opinion and sentiment. Public confidence is now and will be to an increasing degree a prime requisite to the continued operation of the utilities under private control. This confidence can be built up only when the local manager is a thoroughly responsible and highly respectable executive. It can never be achieved with an automaton as local manager.

How can he build confidence?

How can such confidence be built up? It can never be obtained unless it is truly merited. To merit its continued existence the utility business should be econom-

ically beneficial and the greatest benefits to the public should be possible through private ownership and operation. There may be some special instances which seem to disprove this, but the preponderance of the evidence proves it convincingly.

One essential to winning public support is that those responsible for its policies see to it that the benefits, if and when they accrue, are divided equitably between the owners, the employees and the public. What constitutes such equitable distribution, of course, is not obvious, but requires much study.

The attempt to build popularity merely by making financially harmful concessions gains no permanent public confidence. It merely results eventually in rendering the company unable to furnish the high quality of service it should furnish. Nor can confidence be established by attacking every critic of the industry as dishonest. Honest criticisms must be answered honestly. If they are definite and tangible they should be answered. If they are merely vague generalizations they can well be disregarded. The building of confidence may be accomplished by the following steps:

1. By being sure that all practices and policies merit public respect and are fair and sound.
2. By readjusting even those things that are really fair and sound, but which may have "the appearance of evil," so as to eliminate this appearance.
3. By mastering the art of utilizing the laws of public psychology so as to get into the public's mind the truth as to the basis on which affairs are being conducted.

These are some of the things Engineers Public Service had in mind in extending autonomy and responsibility to local managers.

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Protective Schemes for Regulating Transformers

By R. E. CORDRAY

Switchgear Department, General Electric Company

Full protection has been provided the 31,500-kva., 22,500-volt regulating transformers of the Buffalo General Electric Company which buck, or boost the voltage $6\frac{2}{3}$ per cent in four steps each way.

An overcurrent relay placed in the exciting, or shunt voltage, winding would give protection, but it would operate for external short circuits on the transmission lines. In order to overcome this the overcurrent setting is automatically raised by opposing the overcurrent element torque with a torque proportional to the current in the series current winding.

This is accomplished by a relay having one disk acted upon by two elements opposing each other. The operating element, supplied by current from the exciting winding, acts to close the relay contacts. The restraining element opposes the operating element and tends to hold open the relay contacts. This produces a restraining torque varying with the current which is flowing in the series winding.

The initial current setting allows for the constant exciting current and also for the transient inrush of magnetizing current which sometimes occurs when the regulating transformer is switched onto the line. Under these conditions there is current in the exciting winding only and the relay operates as an overcurrent relay. The usual value chosen is 2 amp. secondary, but it is adjustable up to 8 amp.

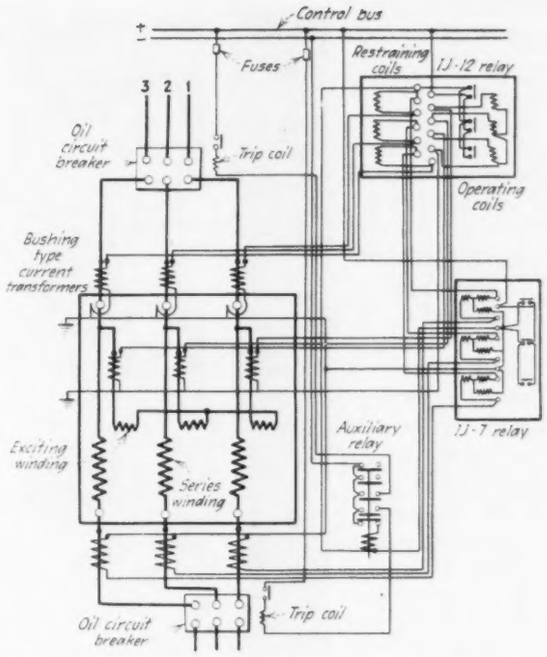

Fig. 1—All elements of regulating transformer protected

The protection afforded by the relay described above and shown in Fig. 2 is excellent for the exciting winding, but its value for the series winding is determined by the particular tap on which the regulating transformer is operating. For example, on the zero buck or boost positions faults in the series winding would draw no current from the exciting winding. Therefore, in order to give protection for the series winding, a current differential relay, similar to that used on generators and transformers, having a percentage characteristic, is employed around the whole regulating transformer unit. Often a regulating transformer is used in conjunction with a power transformer and then it can be included in the power transformer protection, eliminating the need of an extra differential relay.

In the high-voltage regulating transformers it is usually desirable to place the taps and ratio control equipment in a local, medium-voltage circuit, thus requiring two transformer elements—one the excitation unit, stepping down from the transmission voltage; the other the series unit, stepping up again. This frequently results in having more windings in a regulating transformer than the two fundamental exciting voltage and series current windings. The degree of protection given the additional windings depends upon either the current which flows at the time of a fault in the exciting winding or on the unbalance between current entering and leaving the whole regulating-transformer unit (Fig. 1).

It is recommended that the neutral of the exciting winding be not grounded. When it is grounded the regulating transformer acts as a grounding transformer

and the fixed ratio between the exciting and series winding currents changes to a much higher value. To care for this would render the protective equipment complicated.

Phase-angle regulating transformers can be protected by similar relays in the same manner.

When the voltage regulation is by taps on the main power transformer the protection for the transformer and equipment can be included in the differential protection provided for the transformer if a relay of the percentage-differential type is employed, having a slope characteristic in excess of the maximum buck or boost in the voltage. A 25 per cent relay characteristic is an accepted value for a bank having plus or minus 10 per cent voltage regulation.

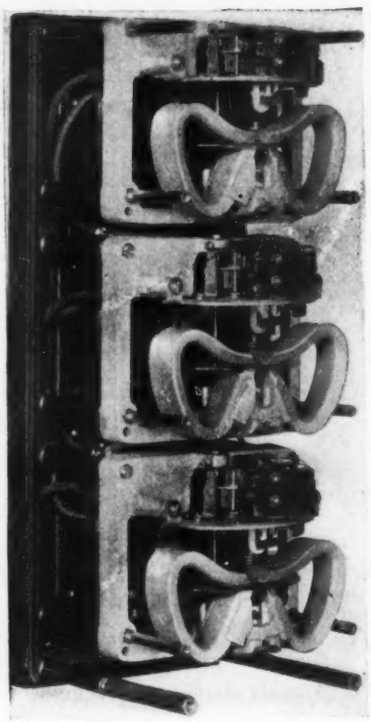

Fig. 2—Differential current relay protects exciting winding

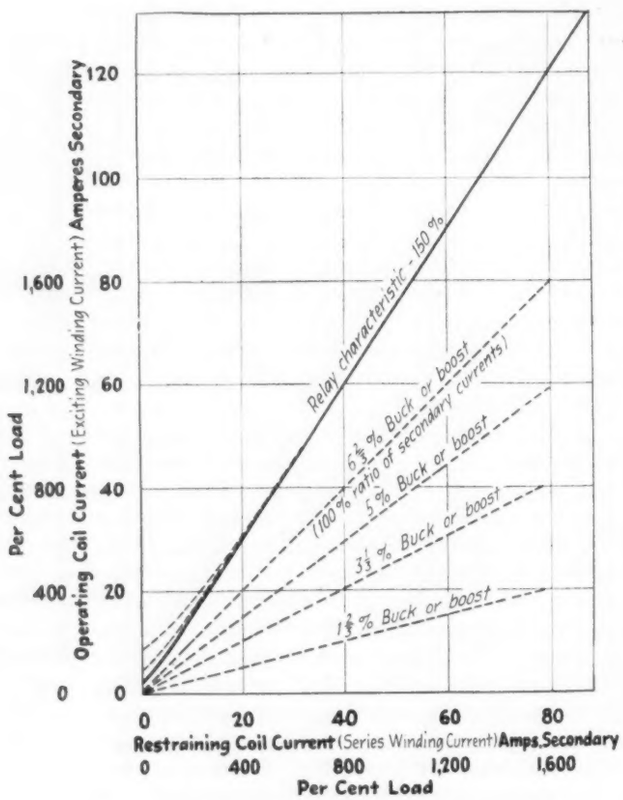

Fig. 3—Current ratios and relay characteristics for regulating transformers

READERS' FORUM

N.E.L.A. Exhibition Committee's Reply to Comments

To the Editor of the ELECTRICAL WORLD:

Mr. MacLean's letter in the August 15 issue of the ELECTRICAL WORLD, bearing on the editorial regarding attendance at the 1931 N.E.L.A. exhibition, is a testimony of the public's interest in the progress of the electrical industry and offers a helpful suggestion.

From the electrical manufacturers' standpoint, the public is most effectively reached by the thousands of utility representatives associated in N.E.L.A. This association includes the largest purchasers and most influential promoters of the sale and use of the manufacturers' products, and its convention offers an ideal opportunity for the manufacturers to present to a body of such importance an exhibit—a physical record of advances, new devices and of progress and improvements in the art.

Any responsible manufacturer and his employees, interested in electric development, are, of course, quite free to join the association upon the payment of modest dues, in return for many privileges and services.

In attendance, number of exhibitors and square feet of space sold the record of N.E.L.A. exhibitions has shown a consistently rapid increase through recent years, excepting only 1931, when economic or political conditions apparently caused a reduction in attendance of utility companies' representatives. The exhibition filled the huge auditorium completely.

The exhibition committee members have frequently tested the desires of its exhibitors with respect to inviting greater numbers to the exhibition. In 1931 members of electrical leagues, of the Association of Electragists International and, through their officers, members of hardware dealers', department-store and other associations were invited to attend with free admission to the exhibition.

The exhibitions have on occasion been open to the general public, no admission fee being ever charged. This was last done in 1929 on the occasion of the dedication of the Atlantic City Auditorium and the celebration of "Light's Golden Jubilee." The vast crowds precluded the possibility of effectively demonstrating any but the simplest products, and many of the exhibitors indicated strong opposition to this feature, because they were unable to demonstrate their wares satisfactorily to those whom they especially wished to interest. Probably our conditions are not at all similar to those under which many other exhibitions are held.

However, the committee, at its meeting on June 30 of this year, voted to open the 1932 exhibition to the general public, free, on the Sunday preceding the convention, and it hopes to have the pleasure of a visit from Mr. MacLean and any others interested in electrical matters who for any reason may not now be ready to take membership in the association.

E. W. GOLDSCHMIDT,
Chairman N.E.L.A. Exhibition Committee.
National Electric Light Association,
New York, N. Y.

Men of the Industry

N. I. Garrison Takes Leave of Absence

N. I. GARRISON, assistant operating manager of the Oklahoma Gas & Electric Company, has taken an indefinite leave of absence after completing 27 years of active service with the Byllesby organization. His career with the Byllesby interests began in 1904, when he was appointed auditor of the Fort Smith Light & Traction Company. While serving as auditor he also held positions as treasurer, secretary or auditor, or a combination of these positions, with several other Byllesby properties in Fort Smith, Ark.

In 1913 Mr. Garrison became general auditor of the Western States Gas & Electric Company at Stockton, Calif., returning later in that year to Fort Smith as assistant manager. After four years he was transferred to El Reno as manager of the Oklahoma Gas & Electric Company, remaining in El Reno as manager until the spring of 1923, when he was transferred to Ada, Okla., where he became manager of the southern division. It was early in 1926 that he became assistant operating manager in Oklahoma City.

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GEORGE T. BISHOP, president of Continental Shares, Inc., has been elected chairman of the board of the United Light & Power Company to succeed Cyrus S. Eaton, resigned. The election took place at a meeting of the board of directors held in Chicago September 1. Mr. Eaton, who withdrew also from the board of the Youngstown Sheet & Tube Company recently, is still head of the investment banking house of Otis & Company of Cleveland.

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O. P. CLEAVER, division engineer Middle Western division, Westinghouse Lamp Company, Chicago, sailed, August 25, on the Cunard liner *Berengaria* for Southampton, to attend the International Illumination Congress at London, England, and Edinburgh, Scotland, from September 1 to 19. Before returning to the States Mr. Cleaver will extend his tour to include France and Germany, where he intends to make a study of European lighting practice.

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F. M. PLAKE of Kansas City, Mo., chief engineer of the Missouri State Public Service Commission, has resigned, effective October 1. Mr. Plake will become valuation engineer for the Union Electric Light & Power Company of St. Louis, Mo. He has been with the Missouri Public Service Commission for ten years, serving as chief engineer for the past 4½ years.

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F. G. MILLIKIN has been named local manager for the Iowa Railway & Light Corporation at Reinbeck, Iowa, with four other offices under his jurisdiction.

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J. T. Chase New Vice-President of Virginia Utility

AT A RECENT MEETING of the board of directors of the Virginia Electric & Power Company J. T. Chase was promoted from manager to vice-president of the company in charge of operations

in northeastern North Carolina with headquarters at Roanoke Rapids. Mr. Chase has a background of 25 years' experience in civic affairs and in the public utility industry in that city, where he first established himself as resident engineer of Jos. H. Wallace & Company. This firm had the engineering contract to supervise the building of the present Halifax Paper Corporation's mill, the steel bridge across the Roanoke River and the power plant of the Roanoke Rapids Power Company, which later became a part of the Virginia Electric & Power Company system.

His activity in the progress of Roanoke Rapids resulted in his election as town commissioner and later as Mayor of the town, which latter office he held for six years. His interest in better roads for the state led to his subsequent election as road commissioner for Halifax County. To stimulate the building of homes Mr. Chase organized and for years was active in the Roanoke Rapids Building & Loan Association and for many years was identified with the cause of public health. He has served on the school board for a number of years and at the present time is also a member of the Roanoke Rapids Sanitary District Board.

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OBITUARY

EDWARD J. CONDON, president of the Condon Engineering Company, Chicago, died, August 25, of heart disease. He was 69 years of age. Mr. Condon was prominently identified with the electrical industry in the Middle West for a number of years, although Massachusetts was his native state. At the age of 21 he went to Chicago as an employee of the Swift Company and after five years entered the United States Revenue Service. Three years later he was appointed superintendent of streets, a position he resigned to assume partnership in a large construction business. In 1906 he organized the Condon Construction Company and supervised the building of electric light, gas and waterworks plants in various states in the Middle West. From 1912 to 1927 he was president and manager of the Indiana Utilities Company and in 1915 served as president of the Indiana Electric Light Association. Mr. Condon was a member of the American Institute of Electrical Engineers, the Western Society of Engineers and other associations.

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HARRY V. CARTER, a pioneer in the electric light and power business in California, died in Oakland, August 17, at the age of 74. He was born at Port Colborne, Province of Ontario, Canada, November 20, 1856. Mr. Carter came to Los Angeles in 1887, where he organized the United Electric Gas & Power Company. He was president of this company until 1904, when the United Electric Gas & Power Company was consolidated with the present Southern California Edison Company. Mr. Carter then organized the Pacific Electrical Works, an electrical supplies wholesale business. He conducted this business until 1909, when the Pacific Electric Works was consolidated with the Sterling Electric Company, San Francisco, and Crescent Electric Company, Oakland, forming the Pacific States Electric Company. He was president of this company until 1916, when he sold his interest and retired from the electrical field.

Financial and Statistical News

THE utility group of long-term bonds has been the only buoyant section of the list during August. Isolated industrials have been relatively firm, but rails and foreign issues have suffered almost steady liquidation. Selling has been attributed to domestic banking troubles and foreign liquidation and relative firmness in the utility list to savings bank and insurance company purchases.

——UTILITY STOCKS MARKED TIME DURING AUGUST. They registered a net advance of about 2 per cent, but market trading has been at the lowest point since the 1921 depression. The ELECTRICAL WORLD average of 37 utility common stocks is now 60.2, against 59 at the beginning of August and 65.7 at the first of the year.

——NEW FINANCING OF $27,000,000 IS THE YEAR'S LOW with the exception of February.

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Tri-Utilities Corporation in Receivership

DEFAULT ON ITS $12,024,000 of 5 per cent debentures on the part of Tri-Utilities Corporation was followed this week by receivership through action of the United States District Court of Delaware.

Tri-Utilities Corporation is a $400,000,000 utility system and serves a population of some 4,700,000 essentially with water and gas. Electric sales in 1930 totaled but 97,700,000 kw.-hr. Power and light companies in the system include Peoples Light & Power Corporation and subsidiaries and West Coast Power Company and subsidiaries.

The receiver named to conserve the rights of creditors and security holders is Hugh M. Morris of Wilmington, Del. Richard C. Hunt, of Chadbourne, Hunt, Jaeckel & Brown, was appointed chairman of a committee that is understood to be attempting a reorganization. The corporation's difficulties are attributed to inability to finance in the current market. The system was built rapidly and properties acquired at top prices.

As of December 31 last, the consolidated balance sheet of the corporation shows assets of $397,487,421. Revenues for 1930 amounted to $38,362,510. G. L. Ohrstrom of the New York banking house of G. L. Ohrstrom & Company, Inc., is president of the corporation.

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Electrical Industry Highly Stable

THERE IS A GREATER STABILITY of employment and wages in the electric light and power industry than in any other major industrial group reporting to the United States Bureau of Labor, according to figures received by the Oklahoma Utilities Association. These figures show more than 285,000 persons now directly on the payroll of the electric utilities with annual wages approximating $440,000,000.

The latest figures of the United States Bureau of Labor Statistics show that the number of employees engaged in the operation of the electric light and power industry is 97.1 per cent of the number employed during prosperous 1929, while the total amount of wages is 97.6 per cent of the wages paid for corresponding periods of that year. Reports on trend of employment show electric light and power industry indices of employment and wages consistently higher than those of all of the 23 other major industrial groups, manufacturing and non-manufacturing, on which reports are regularly issued.

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Pennsylvania Power Is Segregated

SEGREGATION OF THE Pennsylvania Power Company from the Ohio division has been announced by C. S. MacCalla, vice-president of the Ohio Edison Company, in charge of the Youngstown district. Headquarters are being established in Newcastle, Pa., under L. B. Round, vice-president and general manager.

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Accepts Pennsylvania Securities as Legal Investments

FOLLOWING a review of the work and powers of the Pennsylvania Public Service Commission relative to the issue of new securities, the Massachusetts Commissioner of Banks has ruled that the securities of Pennsylvania utilities which otherwise meet with the requirements of the Massachusetts statute are legal investments for savings banks in that state.

The Massachusetts statute relating to the investment by savings banks in that state in the bonds of gas and electric companies of other states requires as a condition of such investment that the corporation issuing the securities must be "any corporation incorporated under the laws of the United States or of any state thereof which is operating under the supervision of a public service or other similar commission of the United States or of any state thereof exercising regulatory jurisdiction therein." At the time of the adoption of this statute the Massachusetts Commissioner of Banks ruled that to qualify securities it was necessary that the public service commission having supervision over the company should have jurisdiction over rates, accounting, securities and valuation.

In order that it might be determined what states complied with this requirement, information was sought from various sources as to the jurisdiction of the various public service commissions. Based on the information so obtained, the Commissioner of Banks ruled that the jurisdiction of the Pennsylvania Public Service Commission over security issues was not sufficient to meet with the requirements, and accordingly the securities of Pennsylvania gas and electric companies were not admitted to the list as legal investments for Massachusetts savings banks.

Early in 1931 the Commissioner of Banks made a further investigation as to the jurisdiction of the Pennsylvania Public Service Commission, from which it developed that the jurisdiction of that commission was more extensive than had been thought to be the case and that the practice of the Pennsylvania commission was such as to meet with the requirements of the Massachusetts statute. This was due to the fact that before a Pennsylvania gas or electric company may issue securities it must file a certificate of notification in the form prescribed by the Public Service Commission, which is required to set

forth in considerable detail all pertinent information with respect to the securities which it is proposed to issue. Until satisfactory information is given by the utility desiring to issue securities, indicating compliance with the provisions of the public service company law with respect to the filing of a certificate of notification, the practice of the commission is not to treat the certificate as filed, and until the certificate is filed securities cannot be issued.

As stated above, the practice of the commission under the public service company law of Pennsylvania is now held to constitute a sufficient exercise of jurisdiction over the issuance of securities to warrant a ruling that the securities of Pennsylvania utilities which otherwise meet with the requirements of the Massachusetts statute are legal investments for savings banks in that state. This should advance their purchase by other institutions.

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Utility Financing Slumps

DURING the month of August new offerings of electric light and power companies of the country totaled $27,975,000, the lowest monthly total of the year with the exception of February, when the new issues amounted to only $27,500,000. This slump may be partially seasonal, but undoubtedly generally unfavorable conditions are affecting the marketing of new securities. Only five utility companies ventured to enter the market and the largest individual issue was offered by the Electric Bond & Share Company in the form of cumulative preferred stock, numbering 100,000 shares, priced at $89.75 per share.

However, in spite of the decline in new financing in August, this year's total for the eight-month period is greater than that recorded for the similar period of 1930—$1,104,920,000 as compared with $967,362,934. It is interesting to note the prominence of refunding operations. Of the total of $1,100,000,000 refunding absorbed approximately $730,000,000, while new capital amounted to only $373,000,000.

The chief July refunding operations included $20,000,000 one-year Commonwealth Edison gold notes, issued at a price to yield 3.62 per cent, to refund other issues and to provide some new capital besides; $10,000,000 West Penn Power 30-year first mortgage bonds, offered at a price to yield 4.23 per cent, to redeem bonds and for other purposes; and $10,000,000 Rochester Gas & Electric one-year gold notes, offered at a price to yield 3 per cent, to retire bonds and for other uses.

In June an issue of $85,000,000 Commonwealth Edison Company general and refunding mortgage long-term bonds was offered at a price to yield 4.25 per cent, of which $65,750,000 represented the refunding portion. A flotation of $32,000,000 Jersey Central Power & Light long-term bonds was offered at a price to yield 4.45 per cent, of which $20,800,000 was for refunding.

In May an issue of $18,000,000 Consolidated Gas, Electric Light & Power Company of Baltimore long-term bonds was offered at a price to yield 4.21 per cent; $16,500,000 Nebraska Power Company bonds, offered at a price to yield 4.37 per cent, and $31,050,000 Public Service Electric & Gas cumulative preferred stock, offered at a price to yield 4.83 per cent, to retire a 6 per cent issue.

In April $35,000,000 Northern States Power long-term bonds, offered at a price to yield 4.65 per cent; $40,000,000 Public Service Company of Northern Illinois long-term bonds, offered at a price to yield 4.62 per cent, and $100,000,000 Pennsylvania Power & Light long-term bonds, offered at a price to yield 4.68 per cent, were in large part refunding issues, although also intended to provide additional capital.

In March the principal refunding operation was an issue of $26,000,000 long-term Public Service Electric & Gas Company bonds, offered at a price to yield 4.32 per cent. In January the $34,984,000 long-term Detroit Edison Company bonds, offered at a price to yield 4.50 per cent, was a refunding issue, while large issues for refunding and general purposes combined included $25,000,000 Pacific Gas & Electric Company long-term bonds, yielding 4.62 per cent; $40,000,000 Philadelphia Electric long-term bonds, yielding 4.34 per cent and $27,000,000 Kansas City Power & Light long-term bonds, yielding 4.33 per cent.

This means of saving, coupled with other operating economies, has helped to improve the position of the public utility companies.

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Recent Listings

NEW YORK STOCK EXCHANGE has authorized the listing of first mortgage gold bonds of the Delaware Power & Light Company to the amount of $13,700,000 as follows: $4,600,000 of the 4¼ per cent series, due Jan. 1, 1969; $3,100,000 of the 4½ per cent series, due Jan. 1, 1969, and $6,000,000 of the 4½ per cent series, due July 1, 1971.

There have also been authorized for listing on or after October 1 not exceeding 4,943 additional shares of common stock of the Federal Light & Traction Company on official notice of issuance as a stock dividend, making the total amount applied for 499,456 shares. Public Service Electric & Gas Company was included in the recent listings. Cumulative $5 preferred stock, numbering 300,000 shares, has been authorized for listing.

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New York Stock Exchange has authorized the listing of 178,178 additional shares of common stock (no par) of the Allis-Chalmers Manufacturing Company upon official notice of issuance, making the total amount applied for 1,436,578.

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Los Angeles Stock Exchange has authorized the listing of 486,789 shares of first preferred stock of the Pacific Public Service Company of no par value and 286,789 shares of common stock of no par value.

New Security Issues of Electric Service Companies in August

Name of Company	Amount of Issue (Par Value)	Period (Years)	Class	Purpose	Interest Rate	Price	Per Cent Yield
Wisconsin Power & Light Co.	$2,000,000	30	First lien and refunding mortgage gold bonds, series G	To reimburse treasury for additional property acquired, for expenditures on additions and improvements and for other corporate purposes	5	103	4.80
Electric Bond & Share Co.	8,975,000	..	Cumulative preferred stock	General corporate purposes	5	89.75	5.57
New York State Electric & Gas Corp.	7,000,000	49	First mortgage gold bonds		4½	99	4.55
Houston Lighting & Power Co	5,000,000	50	First lien and refunding mortgage gold bonds, series E	To retire certain indebtedness and for other corporate purposes	4½	98½	4.57
Interstate Power Co.	5,000,000	26	First mortgage gold bonds	To reimburse for additions to properties and for other corporate purposes	5	88	5.90
Total	$27,975,000			Rights			
Total amount actually realized	$27,290,000			Total financing	$27,290,000		

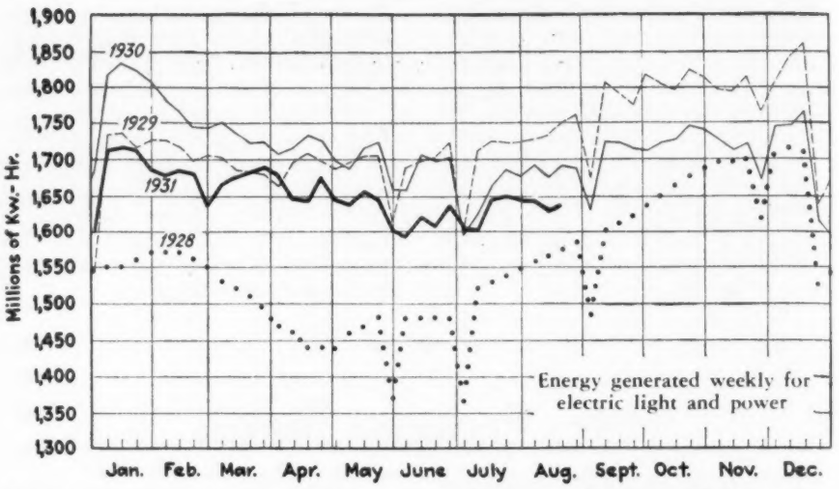
Domestic Electric Sales Show Steady Growth

DOMESTIC USE OF ELECTRICITY for light and power is increasing at the rate of nearly 1,200,000,000 kw.-hr. a year, or more than the entire sales of the electric light and power industry twenty years ago, according to a statement issued by the statistical research department of the National Electric Light Association. This figure is based on a summary of total sales to ultimate consumers for the first six months of 1931, which show an increase in residential use of 7.2 per cent over the corresponding period in 1930 and 22.7 per cent over the first six months of 1929.

"This steady increase in the use of domestic electricity is due to a number of reasons," the statement continues. "During the first six months of 1931 the new residential customers added to the lines of the electric light and power companies bring the total number of such customers up to 20,350,000, or more than 70 per cent of all urban, suburban and rural homes in the country. During the same period, the average annual consumption per domestic customer increased from 548 to 563 kw.-hr. At the same time the average revenue per domestic unit for the United States decreased 1.3 per cent, caused in part by reductions in rates and in part by the increased use of electrically operated household appliances, giving the benefit of the lower steps of rate schedules.

"Another factor is the rapid progress which the industry is making in the extension of rural electrification. According to a statement recently issued by S. H. McCrory, chief of the Bureau of Agricultural Engineering, United States Department of Agriculture, the farmers last year used nearly 2,000,000,000 kw.-hr. of electric power. New rural uses for power are in heating hotbeds and in dehydrating fruits. Mr. McCrory also stated that at present more than 644,500 farms in the United States out of a total of 6,288,643 are making use of electric power.

"New power plants completed in the past six months totaled 670,000 kw., or 900,000 hp., of generating machinery."



Energy Output Rising

DURING RECENT WEEKS central-station energy output has been definitely on the decline, as is usual at this time of the year, and it is now well above that of early summer. For the week ended August 29 the output, compared with the same period of 1930, shows a loss of 3.0 per cent.

During the recent past the weekly output, as estimated by the statistical research department, *N.E.L.A.*, and the comparable output in other years were as follows:

	1931	1930	1929	1928
August 1	1,644	1,678	1,725	1,549
August 8	1,643	1,692	1,730	1,558
August 15	1,629	1,677	1,733	1,567
August 22	1,643	1,691	1,750	1,576
August 29	1,638	1,688	1,672	1,586

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CURRENT EARNINGS REPORTS OF ELECTRIC LIGHT AND POWER COMPANIES

Operating Companies

	1931	1930	Per Cent Increase	Operating Ratio 1931	Operating Ratio 1930
Consumers Power (Year ended July 31)					
Gross earnings	$31,539,018	$33,134,787	—4.8	43	47
Net earnings	17,963,609	17,431,483	3.1	..	..
Detroit Edison (Year ended July 31)					
Gross earnings	50,957,034	55,674,049	—8.5	66	68
Net earnings	17,194,386	18,158,945	—5.3	..	..
Kansas City Power & Light (Year ended July 31)					
Gross earnings	14,861,518	14,719,033	0.9	46	50
Net earnings	8,037,348	7,412,152	8.4	..	..
Ohio Edison (Year ended July 31)					
Gross earnings	18,746,395	19,388,316	—3.3	39	42
Net earnings	11,496,367	11,360,970	1.2	..	..
Puget Sound Power & Light (Year ended July 31)					
Gross earnings	16,425,388	17,042,685	—3.6	..	..
Net earnings	7,103,551	7,283,678	—2.5	..	..
Sierra Pacific Electric (Year ended July 31)					
Gross earnings	1,559,207	1,449,340	7.5	63	57
Net earnings	570,431	623,186	—8.5	..	..
Southern California Edison (Seven mos. ended July 31)					
Gross earnings	23,338,912	23,219,933	0.5	..	..
Net earnings	15,064,277	15,034,476	0.2	..	..
Tampa Electric* (Year ended July 31)					
Gross earnings	4,500,672	4,586,240	—1.9	63	67
Net earnings	1,668,305	1,532,280	8.9	..	..
Virginia Electric & Power (Year ended June 30)					
Gross earnings	17,073,852	17,187,585	—0.7	55	55
Net earnings	7,750,627	7,771,065	—0.3	..	..
Wisconsin Public Service (Year ended June 30)					
Gross earnings	5,591,272	5,598,355	—0.1	..	..
Net earnings	2,293,821	2,424,065	—5.4	..	..

Holding Companies

	1931	1930	Per Cent Increase	Operating Ratio 1931	Operating Ratio 1930
American Power & Light & subs. (Year ended June 30)					
Gross earnings	$85,337,092	$88,168,965	—3.2	48	49
Net earnings	44,404,000	45,655,637	—2.7	..	..
Associated Gas & Electric & subs. (Year ended June 30)					
Gross earnings	84,419,141	84,499,748	—0.0	53	54
Net earnings	39,105,819	38,741,844	1.0	..	..
Cities Service (Year ended July 31)					
Gross earnings	46,150,827	57,759,847	—20.0	..	..
Net earnings	43,530,469	55,889,192	—22.2	..	..
Columbia Gas & Electric & subs. (Year ended June 30)					
Gross earnings	93,429,817	100,369,801	—6.9	50	48
Net earnings	46,781,402	51,889,757	—9.9	..	..
Commonwealth & Southern & subs. (Year ended July 31)					
Gross earnings	134,713,586	146,219,204	—7.9	48	49
Net earnings	70,667,474	74,520,523	—5.2	..	..
Eastern Utilities Associates & constituent cos. (Year ended July 31)					
Gross earnings	9,245,420	9,376,774	—1.4	58	59
Net earnings	3,862,941	3,813,160	1.3	..	..
National Power & Light & subs. (Year ended June 30)					
Gross earnings	78,823,375	81,130,401	—2.8	55	55
Net earnings	35,857,306	36,505,393	—1.8	..	..
Nevada-California Electric & subs. (Year ended July 31)					
Gross earnings	5,801,366	5,624,920	3.1	48	49
Net earnings	3,030,272	2,855,513	5.7	..	..
North American Light & Power & subs. (Year ended June 30)					
Gross earnings	47,135,532	46,714,276	1.0	54	55
Net earnings	21,697,582	21,142,460	2.6	..	..
Public Service Corporation of New Jersey & subs.* (Year ended July 31)					
Gross earnings	139,017,481	138,803,800	0.5	67	69
Net earnings	45,136,851	42,699,721	5.7	..	..

* Operating expenses include depreciation.

Business News and Markets

New 30-Watt Lamps Are Announced

NEW TYPE 30-WATT "Mazda" lamps have been announced both by the General Electric and the Westinghouse companies. Both are priced at 15 cents, and both are available October 1.

The Westinghouse Lamp Company announces a vacuum type 30-watt "Mazda" lamp in a G-19 bulb, designed for a life of 600 hours. It will be supplied in only two voltages, 115 and 120.

The incandescent lamp department of the General Electric Company announces a 30-watt, 115-volt or 120-volt "Mazda" lamp that will serve well in many lighting decorations, some of which are now being planned for the approaching Christmas season. Its life also is estimated at 600 hours.

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Bussmann Manufacturing Gets Fuse Order

AN ORDER FOR 42,000 large power fuses for heavy industrial equipment has been shipped by the Bussmann Manufacturing Company of St. Louis to the Anglo-Chilean Consolidated Nitrate Corporation in Tocopilla, Chile. This is said to be one of the largest single fuse orders ever placed by an industrial organization with an American firm. The fuses are of the new super-lag renewable type perfected by the Bussmann company last year.

The Anglo-Chilean Consolidated Nitrate Corporation is controlled by the Guggenheim interests.

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Abbott's Analysis of New Code Complete

THE CURRENT REVISION of the National Electrical Code, upon which the electrical committee acted last February and which was approved by the National Fire Protection Association recently, has been carefully analyzed by A. L. Abbott, engineer, of the uniform legislative department of the National Electrical Manufacturers' Association. This analysis is ready for distribution.

The analysis was made on account of the large number of changes the revision contains this year which probably affect the industry more than any other previous revision. Each changed rule is reprinted and compared with the corresponding 1930 rule. These rules, together with each amendment, are briefly explained to bring out the significance of the change.

"The Analysis of the 1931 Revision of the National Electrical Code" is approximately 130 pages in the approximate size of the National Electrical Code. It is being published by the National Electrical Manufacturers' Association as a contribution to the industry, which will distribute 10,000 free copies to the members of the International Association of Electrical Inspectors, the National Electrical Manufacturers' Association, the National Electric Light Association, the Association of Electragists International and the International Association of Municipal Inspectors. Additional copies can be obtained by any one at 10 cents per copy from the officers of the association.

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How the Electrical Leagues Help the Manufacturer*

By FRED R. FARMER

President Beardslee Chandelier Manufacturing Company

A 30-YEAR background in the hurly-burly of manufacturing has forced upon me the fundamental that the financial health of my business makes co-operation in the electrical industry an economic necessity. What are the purposes and aims of the electrical leagues? Functionally each league may:

1. Do for a member that which he cannot do for himself. This may consist of training the public or even the industry to be open-minded or to keep an open mind.

2. Improve markets by more intelligently co-ordinating the industry's position in relation to other industries which are also seeking to attract the user's dollars.

3. Increase sales for members' merchandise by
   (a) Gathering and sifting information.
   (b) Distributing information.
   (c) Promoting use of information.
   (d) Bringing about more favorable opinions on part of buying public and those who influence buyers.
   (e) Engaging in selling and promotional activities.

4. Improve quality and quantity of personal contacts by
   (a) Enrolling all subdivisions of the industry.
   (b) Organizing frequent "get-togethers."
   (c) Forming educational groups.
   (d) Promoting understanding and confidence to the end that leadership and support shall be always present when any task needs doing.

I find that the work of leagues divides into two kinds—aggressive and defensive. A league may tie into some product like refrigerators, washing machines or ranges and dynamically promote their sale, but these are relatively few in number. A broad program will attract many more manufacturers—those whose goods form but a part of the final sale and who get indirect benefits. I have in mind those whose products are wire, conduit, schedule material, entrance and service switches, etc. The "Red Seal" is a fair example of an aggressive, though broad activity. Being one of the many who get only indirect, if actually any, benefits from league efforts of an aggressive nature, I look to the defensive efforts for my benefits from league membership.

Defensive results—to me a league membership is insurance. How or where else can we so readily obtain the benefit of others' experience? Progress comes from "exposure to" and "collision with" other folks' views. Where else may we so quickly and easily be made aware of and sensitive to industry opinion? Where else is afforded a forum wherein to educate and be educated? When we are through changing we are through. After all, wisdom is adjusting, balancing and putting knowledge in perspective. We must have facts—the league can supply them. There, too, we learn to know and to rate competitors accurately. Competitors largely control our profits, regardless of whether they sell our kind of goods or an entirely disassociated item competing for the usable surplus above living costs of those to whom we hope to sell.

It has been said, and I believe rightly, that 60 per cent of the profit-making

**From a recent address before Camp Co-operation XI, Association Island, N. Y.*

factors are outside the control of my immediate business, and to whom would you rather delegate the influencing of these factors? Then, too, the league can assist me in answering or solving some of the present marketing problems, embracing reduction of marketing costs, new methods of distribution, changes in demand, public acceptance, salesmen's training, etc. True, a manufacturer might do all of this for himself—but at what a cost?

What does it cost? The cost is twofold—time and money. Why spend the time? Only because by so doing you can do in a more effective way what you have to do any way. Why spend the money? Only to pay or help pay for what must be done by others and what you can't do yourself. Common sense will dictate that this cost must be less than you would pay for the same results by any other means.

Should I join? The truth of the situation is that in these days of complex, intricate and below-par sales I don't dare miss any opportunity to add to my store of facts, and nothing takes the place of the league. Leagues may and sometimes do creak at the joints. Local leagues have been known to do foolish things—much misguided effort has been expended. The future will see more energy wasted. But there isn't anybody else in sight to do what they try to do.

Any league's limiting factor is its quality and quantity of membership. Perhaps it's better to say that any limiting factor is the effective spirit of its members, either large or small in number. If the "go-to-it" spirit is good, then results are produced. Joining, to me, means I have a better chance to do what I must do any way, and the dues pay for doing what I can't do myself. Yes, leagues are a necessity to manufacturers, and they must join to give both time and money to accomplish that which will make net profits possible.

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Lists the Cities Using Creosoted Pine Poles

A SIXTEEN-PAGE BOOKLET listing the cities in the United States that use creosoted pine poles has been issued by the International Creosoting & Construction Company, Galveston, Tex.

Early in the history of the development of the creosoted pine pole question was raised as to its use on city streets. It was feared that the bleeding of some of the poles might cause trouble if the clothing of pedestrians rubbed against them. Advances in treating-plant machinery and in the science of timber treatment have provided a drier pole than that of years ago, and this is one of the factors that account for the installation of creosoted pine poles in cities everywhere.

Copies of the booklet may be obtained by addressing the International Creosoting & Construction Company, Galveston, Tex.

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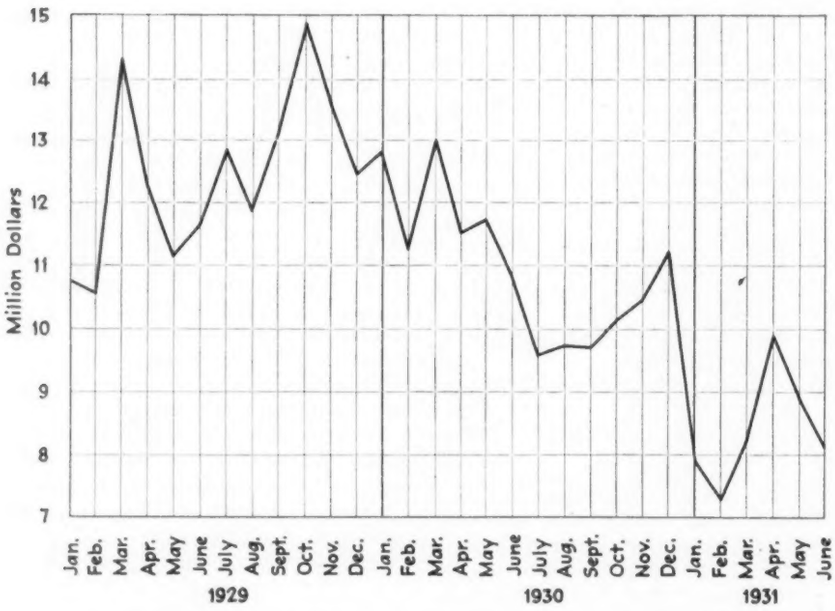
Business Depression Curtails Exports



Effect of business depression upon export trade is seen in the steady decline in monthly electrical export figures. The trend has been downward since October, 1921.

Refrigeration Division of N.E.M.A. Meets

MEETINGS OF THE various committees of the Refrigeration Division of the National Electrical Manufacturers' Association were held at the Dayton Country Club recently, when the division and its committees were the guests of the Frigidaire Corporation. The division also met as a unit.

The industrial research committee's plan for individual member co-operation with the Frozen Foods Association was unanimously approved by the division. The plan recommends that the individual members lend their support by joining and forming a refrigeration division of that association. Several of the division members indicated their intention of making application for membership in the F.F.A.

That the National Fire Protection Association at its meeting May 14 voted to support the A.S.A. code and abandoned effort to adopt an ordinance was reported by the codes and ordinances committee.

A number of states, cities and municipalities were reported to have been assisted materially by Glenn Muffly in developing and co-ordinating the details and technical aspects of their contemplated refrigeration codes and ordinances. Mr. Muffly stands ready to assist any state, city or municipality which contemplates the development of a refrigeration code.

A code of ethics presented by the commercial practices committee was accepted by the division for submission to counsel for approval. It was decided that after review by counsel the code would be submitted to the members, together with his comments and suggested corrections, for adoption by letter vote.

A study of time financing of refrigerators and refrigeration equipment was recommended by the commercial practices committee. The division approved the recommendation and assigned the subject to that committee for investigation and report.

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TRADE BRIEFS

The Worthington Pump & Machinery Corporation has acquired the manufacturing and marketing facilities of Metalweld, Inc., Philadelphia.

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The Wheeler Reflector Company of Boston announces the opening of a new subsidiary plant at 44 York Street, Toronto, known as the Wheeler Reflector Company of Canada, Ltd.

•

The Norma-Hoffmann Bearings Corporation announces the opening of a sales office at 1014 American Bank

Building, Parkway and Walnut Street, Cincinnati. C. D. Kilham has been made manager in charge.

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John J. Stanton has been appointed Milwaukee manager of the Westinghouse Electric & Manufacturing Company, covering Wisconsin and the upper peninsula of Michigan.

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E. W. Loomis has been appointed as Middle Atlantic district manager of the Westinghouse organization.

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The Leland Electric Company reports for six months ended June 30 a net profit of $80,401 after charges and taxes, equal to $2.01 a share on the capital stock, compared with $28,015, or 70 cents a share, in the first half of 1930.

•

The incandescent lamp department of the General Electric Company at Nela Park, Cleveland, announces that 2,500-lumen, 4,000-lumen and 6,000-lumen street series lamps of 6.6-amp. and 7.5-amp. ratings are now available with inbuilt cut-outs in the bases.

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New York Metal Prices

	Aug. 26, 1931 Cents per Pound	Sept. 2, 1931 Cents per Pound
Copper, electrolytic	7½	7½
Lead, Am. S. & R. price	4.40	4.40
Antimony	6.55	6.60
Nickel, ingot	35	35
Zinc, spot	4.15	4.15
Tin, Straits	27.00	26.70
Aluminum, 99 per cent	23.30	23.30

New England Industries Are Picking Up

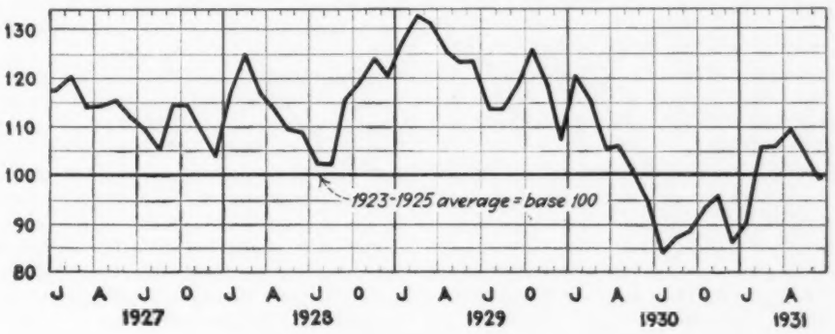
INDEX numbers of industrial activity in New England based on monthly returns received by ELECTRICAL WORLD showing electrical energy consumption in numerous representative plants in the various industry groups are given in the accompanying table, published in response to requests for regional data similar to those announced each month for the United States as a whole.

Adjustments have been made for differences in the length of the working month, but not for seasonal variations. The chart shows the weighted averages for all industrial groups combined.

The two recent depression points, the last in December, 1930, are clearly evident, as is also the subsequent rise. The table brings out the upward movement in textiles since midsummer of 1930, which has contributed largely to the regional recovery.

Electrical World index of industrial activity in New England, 1927-1931

Based on return of electrical energy consumption. Adjusted to 26 working days.



Indices of Industrial Activity in New England—Adjusted for 26 Working Days

	1927 Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1928 Jan.	Feb.	Mar.	Apr.	May	June
All industry	117.2	120.4	113.4	114.0	115.2	112.0	109.3	105.4	114.0	114.0	109.7	103.9	115.2	125.2	116.9	113.8	109.1	108.4
Chemicals	107.8	130.7	102.5	140.5	162.0	112.0	118.0	111.2	93.7	92.2	92.2	88.8	120.0	135.8	134.8	140.2	142.5	109.4
Iron and steel	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	131.7	110.0	130.6
Metal-working plants	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	125.6	124.4	126.4
Metals group	117.7	124.8	113.7	114.4	114.8	110.8	103.2	106.5	126.0	124.6	125.3	124.2	125.8	133.1	120.6	127.3	120.2	127.6
Leather	94.1	100.8	93.5	95.2	96.0	86.4	86.1	98.5	104.2	99.7	98.0	87.8	96.0	108.4	100.6	91.7	83.8	79.5
Lumber	.....	.....	.....	113.3	105.9	92.7	114.5	107.0	134.6	113.2	114.5	87.0	96.2	115.4	110.7	117.2	103.2	103.4
Paper and pulp	128.7	130.3	116.0	111.0	110.3	135.3	124.3	115.2	119.5	120.5	102.1	100.9	139.0	143.0	136.2	121.2	120.0	116.6
Rubber	111.3	123.5	114.8	117.2	117.5	113.4	104.0	101.3	109.4	111.2	112.0	93.2	107.0	126.0	120.4	119.2	125.0	127.9
Textiles	121.7	116.9	120.0	115.0	119.9	116.5	115.2	106.4	109.2	114.7	99.0	94.2	103.9	114.2	107.3	98.3	96.3	93.7

	1928 July	Aug.	Sept.	Oct.	Nov.	Dec.	1929 Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
All industry	102.4	102.2	115.3	119.3	**124.4**	120.2	127.6	132.8	130.8	125.4	123.3	123.5	113.4	113.2	118.2	126.2	118.1	107.0
Chemicals	119.4	112.7	123.0	122.5	135.3	146.2	139.0	153.2	133.3	126.4	126.5	150.8	126.5	124.0	132.6	161.8	149.6	144.5
Iron and steel	137.8	150.5	194.5	197.2	208.5	194.0	222.2	227.0	230.7	191.0	199.2	195.2	195.5	203.2	222.0	203.5	220.4	181.3
Metal-working plants	126.2	121.5	138.2	140.5	153.3	144.5	153.2	170.2	176.0	154.7	147.0	151.7	140.8	140.5	142.0	143.2	140.5	130.9
Metals group	129.6	129.8	154.2	156.7	169.2	158.8	173.0	186.7	191.7	164.5	162.1	164.2	156.8	158.3	163.0	160.0	162.8	145.2
Leather	78.8	69.6	77.3	80.0	65.6	66.0	71.3	69.9	68.0	77.8	66.1	73.7	62.6	77.4	81.7	71.2	70.8	67.2
Lumber	94.8	74.9	75.5	78.3	80.3	115.4	82.0	104.2	58.7	94.6	99.8	117.0	60.2	93.9	85.0	85.8	64.6	49.2
Paper and pulp	115.2	119.1	119.0	126.0	115.8	116.6	118.4	124.1	118.4	135.8	121.8	120.8	115.6	108.6	115.3	134.0	131.3	117.3
Rubber	125.4	126.4	150.0	144.8	136.3	109.8	140.6	129.4	138.2	125.0	131.8	119.0	112.6	109.8	116.9	113.6	107.2	106.8
Textiles	74.8	78.3	85.2	89.4	99.7	95.3	101.6	98.9	97.2	100.4	101.8	94.7	86.0	77.5	82.5	100.4	83.1	75.6

	1930 Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1931 Jan.	Feb.	Mar.	Apr.	May	June
All industry	120.5	115.2	105.0	105.9	101.3	94.2	83.5	87.1	88.1	93.2	96.3	86.3	90.2	105.5	105.8	109.4	104.4	98.4
Chemicals	131.6	137.2	145.2	148.2	156.2	114.2	111.7	117.0	122.4	137.4	172.8	120.4	153.5	185.8	178.9	161.4	163.3	165.1
Iron and steel	206.5	173.7	174.0	159.2	157.3	155.1	152.3	141.8	136.2	174.9	149.5	137.1	123.8	147.3	153.5	147.2	139.0	115.3
Metal-working plants	146.0	148.3	124.7	123.2	110.8	99.2	94.2	98.0	99.4	101.5	106.7	104.5	102.0	117.0	115.0	112.4	104.1	97.4
Metals group	163.2	155.8	138.9	133.2	124.2	114.2	110.5	110.4	110.0	122.0	116.9	92.1	107.3	125.3	126.0	119.2	114.4	102.5
Leather	80.8	75.8	70.2	75.9	70.8	88.5	68.8	70.0	67.7	83.4	65.0	58.9	72.6	75.6	77.3	87.8	77.0	71.6
Lumber	62.1	48.8	48.5	55.8	50.8	47.5	49.3	49.2	46.9	34.0	43.6	39.1	42.8	52.3	48.2	50.8	50.3	49.4
Paper and pulp	124.1	138.7	128.7	115.0	121.4	116.5	120.8	102.5	103.3	128.6	107.5	96.0	107.6	122.7	152.0	146.5	145.6	149.6
Rubber	137.4	115.2	101.2	113.8	122.0	79.6	78.7	79.2	10.0	86.4	95.5	80.9	82.0	81.7	74.6	78.8	87.0	93.4
Textiles	89.4	74.6	75.2	80.2	73.5	70.8	50.5	58.1	64.3	57.2	72.8	72.3	75.2	82.5	79.3	87.5	89.1	83.2

Market Conditions

THE equipment market in the East is developing an encouraging outlook in connection with large building projects, especially for government purposes. Central-station buying, on the other hand, has been almost at a standstill in spite of a fair volume of inquiries for big equipment. Street-lighting equipment is promising.

——POWER COMPANY BUYING ON THE PACIFIC COAST HAS INCREASED and there are indications of a revival of industrial buying. The Southeast reports more activity in the electrical field than for many weeks.

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PACIFIC COAST

—THE PAST WEEK'S MARKET *has featured power company sales and prospects on one hand, and on the other a possible hint of the long-expected awakening of the industrial market after an eighteen-month lethargy, though it is too soon yet to say whether this comeback is permanent.*

—POWER COMPANIES' REPORTS *show a good increase in domestic home load, reflecting appliance and range sales, made during the past year, but also showing a marked decrease in industrial revenue. Possibly because of this fact new construction and installation in North California estimated at $1,000,000 have been postponed pending a real need for it.*

The Los Angeles municipal plant is preparing an additional 18,000-hp. installation near Saugus, estimated to cost $1,000,000 when complete for operation. It is the third unit and will bring the installation to 60,000 hp. Central California building is featured by a $4,000,000 construction program of the Catholic Church, comprising schools, colleges and other eductional institutions, the structures being well distributed. Government purchasing was considerably boosted by the recent visit of the fleet to San Francisco bay. Orders include 2,000 radio batteries, maintenance material and arc-welding equipment for Mare Island and $25,000 worth of radio tubes. The industrial purchasing included $11,000 worth of Westinghouse motors for Marion Steam Shovels, $15,000 worth of motors for driving pumps in an oil refinery, built in San Francisco, but for shipment to Tulsa, $17,000 worth of motor parts for a pump manufacturer in Pomona, and $3,500 worth of pumps and motors for Berkeley. Retail business is very slowly improving, California records showing that such sales have increased 6 per cent in the Bay area and 2 per cent in southern California over the previous month. Collections, however, have shown a 5 per cent rate of decrease at the same time. Railroad buying is reduced to lowest dimensions, although accumulated needs and the necessity of purchasing have produced such orders as a half carload of dry batteries and sizeable lots of line material.

A constantly increasing number of oil-burning heating installations in Seattle residences are reported by dealers, August sales totaling in excess of 100,000 not including about $15,000 worth of automatic electric control equipment. Sales of small motors and control equipment for fruit handling in eastern Washington orchard districts are reported heavy. Wire and cable sales are practically nil, with no business in sight before the first of the year. This also applies to poles and pole line hardware. With the exception of a small movement of miscellaneious switchgear and some small distribution transformers, apparatus sales recently approximate only a few thousand dollars. The city of Seattle, through the purchasing department and Board of Public Works, within the next two weeks expects to buy a considerable number of distribution transformers, ranging from 10 to 150 kw., and last week purchased about 200 poles from 45 ft. to 90 ft. Sales reported included 25 transformers from 1½ to 50 kva., 30 motors from 75 hp. down to small industrials, including fruit and vegetable canneries; 45 machines from 150 hp. down, the majority under 50 hp. to pulp and paper mills, wood-working plants and miscellaneous sources, and ten machines from 25 hp. down to sawmills.

CONSTRUCTION PROJECTS

Stauffer Chemical Company, Los Angeles, Calif., plans plant to cost about $75,000. Long Beach, Calif., has plans under way for public utility building to cost $100,000. Owens-Illinois Glass Company, Toledo, Ohio, contemplates call for bids in September for branch plant at Alameda, Calif., to cost close to $1,000,000. Portland Battery Manufacturing Company, Portland, Ore., plans factory to cost about $100,000. Seattle, Wash., contemplates expenditure of $5,000,000 for hydro-electric power plant and extensions in transmission lines. National Steel Construction Company, Seattle, Wash., plans plant improvements to cost over $70,000.

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SOUTHWEST

—THE AUTUMNAL INCREASE *in electrical business has commenced a little earlier than usual. While there has been no change in the demand for stock sizes, the utilities are buying a little more freely and there is increasing activity in the Illinois coal mining region.*

Orders have been reported for the following apparatus. A lot of induction voltage regulators costing $9,000; telemetering equipment, $5,000; turbine repair parts, $7,500; substation equipment, including transformers, oil switches and steel work, $7,500, and a portable automatic motor-generator set for an Illinois coal mine, $6,500.

CONSTRUCTION PROJECTS

Board of Public Works, Kansas City, Mo., plans hangar and shop at municipal airport to cost close to $200,000. State Board of Affairs, Oklahoma City, Okla., has approved plans for vocational training school at institution at Sulphur, Okla., to cost $85,000; also, plans new buildings at institution at Taft, Okla., to cost $100,000. Gulf States Utilities Company, Beaumont, Tex., plans transmission line from Sabine Lake to county line, about 28 miles. Signal Officer, Signal Corps, United States Army, Eighth Corps area, Fort Sam Houston, Tex., will receive bids until September 18 for an underground telephone conduit system.

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SOUTHEAST

—LAST WEEK WITNESSED *more activity in the electrical field of the Southeast than has been noted for many weeks past. However, it is not felt that this is anything more than a temporary pick-up, for the tone of business is generally quiet over the entire territory.*

A Georgia power company let orders for $11,000 worth of regulators, $6,700 worth of distribution and small power transformers, $3,800 worth of oil circuit breakers and $3,800 worth of lightning arresters. Oil circuit breakers and disconnect switches amounting to $10,000 were ordered for a cable company in Alabama, while a Tennessee company purchased $10,000 worth of power cable and three 333-kva. transformers. A cotton mill in Georgia ordered 50,000 spindles, 200 7½-hp. motors, complete with magnetic type switches, and 200 texrope drive, this equipment for replacement use. Another cotton mill in the same state ordered motor and transformer equipment amounting to approximately $40,000 and a rayon plant

in Tennessee ordered a turbine costing in excess of $30,000.

CONSTRUCTION PROJECTS

Harvey Paper Mills Company, Wellsburg, W. Va., plans addition to cost close to $50,000. Kentucky & West Virginia Power Company, Hazard, Ky., plans installation of street-lighting system at Ashland, Ky. Dixie Terminal Company, Atlanta, Ga., plans early construction of multi-story dry and cold storage plant at Atlanta, Ga., to cost close to $1,000,000. Georgia Forestry Association and State Department of Forestry and Geological Development, both Atlanta, Ga., plan experimental paper and pulp mill to cost $75,000 and have secured appropriation.

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NEW ENGLAND

—THERE WAS LITTLE CHANGE *in the trade trend in this district during the past week except for slight signs of more steadiness in buying small power equipment and some noticeable increase in inquiries for electrical materials.*

—SMALL MOTOR SALES *show little change over the trend which has continued at a low scale during the past month and inquiries for heavy equipment are few. On the other hand, the volume of scheduled material sales is holding up well; small switch sales are steady and a few orders for inside switches received from a Massachusetts power company were noted among last week's sales. Also reported was a demand for line materials on closing jobs in this district.*

Among active specialties attracting attention are noted increasing sales of electric water heaters, a lot of twenty being recently placed by one prominent manufacturer. In addition an electrical cooking equipment was recently installed in a Maine institution. Of interest are recent sales of equipment for sound recording amounting to over $20,000. A new contract soon to be placed for similar apparatus used for police broadcasting services amounting to about $40,000 is reported. Continuance of marine equipment sales is reported by one manufacturer and wiring contracts involving installation of lighting service for institutions are increasing in number. Appliance sales are showing little change, though dock sales are outstanding recently, 500 being sold the past month in the Maine district.

CONSTRUCTION PROJECTS

Pepperell Manufacturing Company, Biddeford, Me., will establish new cotton mill unit at Lindale, Ga., to cost over $100,000, and is ordering machinery. Pacific Mills, Inc., Lawrence, Mass., contemplates expansion program at branch dyeing and finishing plant at Lyman, S. C., to cost over $65,000. Arrow-Hart & Hegeman Electric Company, Hartford, Conn., has plans for an addition to its electric equipment manufacturing plant.

EASTERN

—MATURING LARGE BUILDING PROJECTS *for the government and private interests are bringing some sizable awards for electrical equipment and supplies in the Eastern district. With some heavy prospective business to be closed for similar account during the next few weeks, the market is developing an encouranging outlook in this line.*

—CENTRAL STATIONS, *on the other hand, continue to mark time in connection with equipment commitments, and while inquiries are holding at fair volume, it is exceedingly difficult to turn these into orders. Wire and cable show improved call, particularly for early government requirements. Street-lighting apparatus gives promise for some good business during the next 30 to 60 days.*

Electric elevators are scoring some record orders for the year. The Otis Elevator Company has secured a contract for such equipment for the new Marshall Field building at Chicago, totaling close to $1,000,000. The elevator division of Westinghouse Electric & Manufacturing Company will furnish units for the new post office buildings at New York and Chicago, aggregating about $740,000 and $200,000 respectively; another large order covers electric elevators for the new building for the Bankers Trust Company, New York, for $700,000. The S. Heller Elevator Company, Milwaukee, Wis., is low bidder for a unit for the Pearl Harbor navy yard of the government.

While industrial demand is noticeably restricted, the outlook for better fall buying looms ahead. A leading contracting interest, specializing in industrial buildings, reports awards for new plants over 70 per cent higher in August, as compared with July business, one week alone during the first noted month showing more than $300,000 for industrial structures. Motor demand has trended downward for several weeks, and there is little prospect for immediate change. Railway account has grown quiet, with a temporary lull, as well, for marine equipment. Graybar Electric Company, New York, will furnish equipment for an ornamental street-lighting system at Dallas, Tex. Anaconda Wire & Cable Company has secured an award for wire from the city of Los Angeles, Calif.

CONSTRUCTION PROJECTS

Signal Supply Officer, Signal Corps, United States Army, Army Base, Brooklyn, N. Y., will receive bids until September 14 for a quantity of insulators, various types (Circular 14); until September 15 for quantity of wire in lots of 3,000 to 9,000 miles (Circular 12); until September 15 for quantity of reels in lots of 3,000 to 9,000 (Circular 15). New York Central Railroad Company, New York, has taken out a permit for a multi-story warehouse and distributing building to cost $350,000. Standard Oil Company of New York, New York City, plans bulk oil storage and distributing plant at Dunkirk, N. Y., to cost about $300,000. Congoleum-Nairn, Inc., Kearny, N. J., is having plans drawn for a linoleum manufacturing plant at Bay Point, Calif., to cost over $1,000,000. Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids until September 15 for quantity of electric fans for Philadelphia, Annapolis and other navy yards (Schedule 6426). Hutzler Brothers Company, Baltimore, Md., will build an addition to department store to cost over $175,000. Office of the Architect of the Capitol, Washington, D. C., will receive bids until September 17 for a street-lighting system, Botanic Garden.

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MIDDLE WEST

—THE END OF *August finds no great acceleration in business over the past few weeks, yet there is a distinct disposition to indulge optimistic hope of what may happen in September.*

—PRESS REPORTS INDICATE *that the Ford shutdown which began August 1 will be broken by the reemployment of 15,000 men before the middle of September. Unofficial reports state that this number will be increased to 50,000.*

Steel production activity in the Detroit area is indicated on the increase in the near future by a major plant extension of one large producer. This straw perhaps shows the direction of the wind in the automobile industry. There is evidence that retail prices, lagging always behind wholesale quotations, have finally reached bottom and that the retail buyer is making up his mind that this is true. While consumption of electricity in industry is not making any spectacular gain, it is not showing any striking decrease. It may be said, perhaps, that those who are employed have begun to be less afraid to spend their money.

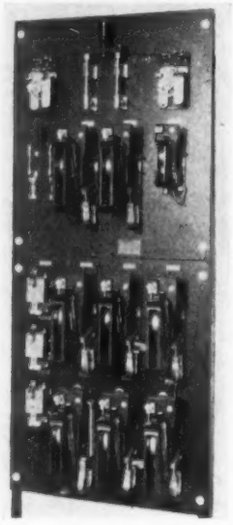
CONSTRUCTION PROJECTS

Three Lakes, Wis., is arranging an appropriation of $20,000 for an ornamental lighting system. Board of Vocational Education, Manitowoc, Wis., plans new call for bids for vocational training school to cost $200,000. Murray Corporation of America, Ecorse, Detroit, Mich., plans addition to metal stamping plant to cost over $100,000. Firestone Tire & Rubber Company, Akron, Ohio, plans factory branch, service and distributing plant at Chicago, Ill., to cost $350,000. American Manganese Steel Company, Ill., has purchased property at Welland, Ont., for new branch plant to cost $200,000. Standard Oil Company of Indiana, Chicago, Ill., plans extensions and improvements in oil refining plant at Whiting, Ind., to cost about $2,000,000. Northwood, N. D., has authorized an electric lighting plant and distributing system.

New Equipment Available

Controllers for Mill Applications

A COMPLETE LINE of direct-current magnetic controllers for heavy-duty service with series, shunt or compound-wound direct-current motors has been announced by the Westinghouse Electric & Manufacturing Company. They are used on mill and material handling



applications such as roll tables, screwdowns, shears, bar pullers, ingot buggies and other service in which quick and accurate stopping is necessary.

The control panel consists of an ebony asbestos lumber base supported on a substantial angle-iron framework. Type SM contactors of a new design and high rupturing capacity are employed on these panels. Inverse time-limit overload protection is provided by a new thermal overload relay, which also trips instantaneously on abnormal overloads. The relays reset instantaneously.

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Combined Safety Switch and Magnetic Contactor

A COMBINATION SAFETY SWITCH and magnetic contactor for use with small a.c. motors has recently been introduced by the Rowan Controller Company, Baltimore, Md. The equipment can be furnished up to and including 5 hp., 220, 440 or 550 volts. Overload protection is furnished in other Rowan equipment for those who prefer this feature for small motor operation. The unit is compactly built, so that it occupies a minimum space, and the fact that it is completely oil-immersed makes it vapor-proof, weather-proof and dust-tight.

Because of its rugged construction and its completely oil-immersed feature, it has aroused interest among engineers in charge of steel mills, gypsum plants, oil refineries, chemical plants and cement plants.

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CERTAIN IMPORTANT CHANGES IN THE MECHANISM of the Bethlehem pulverizer are announced by the Grindle Fuel Equipment Company, which has taken over the manufacture and sale of the table roller pulverizer. These changes include adjustments in the design of the bearings, rollers, lubrication, setting of the table on the main shaft, and the seal protecting the driving gear against any dust. One-piece tracks are replacing the segmental tracks used previously. Furthermore, it is possible now to run the pulverizer at very low capacity or at maximum capacity with equally good results. The chief advantages claimed are low power consumption and long life of the grinding elements.

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Single-Phase Directional Distance Relay

A DIRECTIONAL DISTANCE RELAY, designated type GAX, has been announced by the General Electric Company. It is applicable to single and parallel transmission lines for rapid protection against phase-to-phase, three-phase and double-ground faults. The relay functions to isolate immediately faults occurring within the protected section, to operate in a longer time on faults in the neighborhood of the next section, and in a still longer time on faults in other sections to which it is desired to give back-up protection.

The operating time of the relay depends solely upon the reactance of the line to the fault, which is taken as a direct measurement. It is unaffected by the resistance of an arc at the point of the fault, it is claimed.

It is a single-phase device, comprising a starting unit, an ohm unit and a timing unit. The starting unit indicates that there is a fault, the ohm unit indicates where the fault exists and the timing unit sets the time in which the relay trips the oil circuit breaker which isolates the fault.

Time Switch Has Self-Starting Motor Movement

A TIME SWITCH with self-starting synchronous motor movement made by the Waltham Watch Company has been announced by the Triplex Products Corporation, Clifton, N. J. No winding is necessary, thus obviating periodic trips to the time switch. Accurate electric time is visible at a glance through a glass window in the door of a cadmium-plated steel housing. These switches may also be obtained in weatherproof housings. The housing may be padlocked or sealed and is furnished with knockouts at sides, bottom and back.

The switch unit comprises a "Mercoid" snap-action switch mechanism and "Mercoid" mercury tubes, operated by easily set "on" or "off" control clamp cams. The time switch may be obtained in 20, 40, 60 or 80-amp. capacities at 110/220 volts, with the synchronous motor arranged for 110 volts, 60 cycles. Clock motors for 220 volts or for 50 cycles may be supplied.

Normally the switch is supplied with one "on" and "off" control clamp cam. If desired, additional sets of clamp cams may be furnished. The minimum operation time cycle of the switch is 30 minutes.

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A NEW PORTABLE PIPE CUTTING AND THREADING MACHINE, simple and rugged in design, has been announced by the Borden Company, Warren, Ohio. It will cut, thread and ream ½ to 2-in. pipe, steel, wrought iron, brass or cast iron. Three opening die heads are supplied, ½ x¾ in., 1 x 1¼ in. and 1½ x 2 in. Dies are adjustable for over, under or standard. It is not necessary to back off over finished threads. It has a ½-hp. universal motor, reversible at the switch. It is connected with flexible volt light line.